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THE FOUNDRY

Established in 1892 by John A. Penton

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1933

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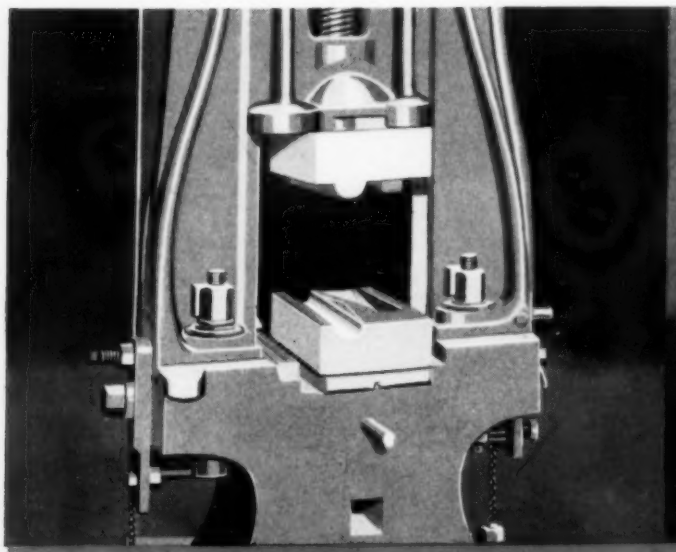
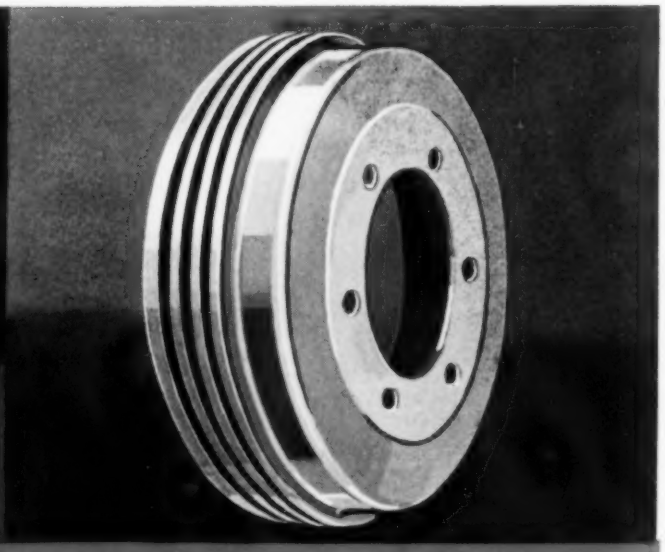
MOLY

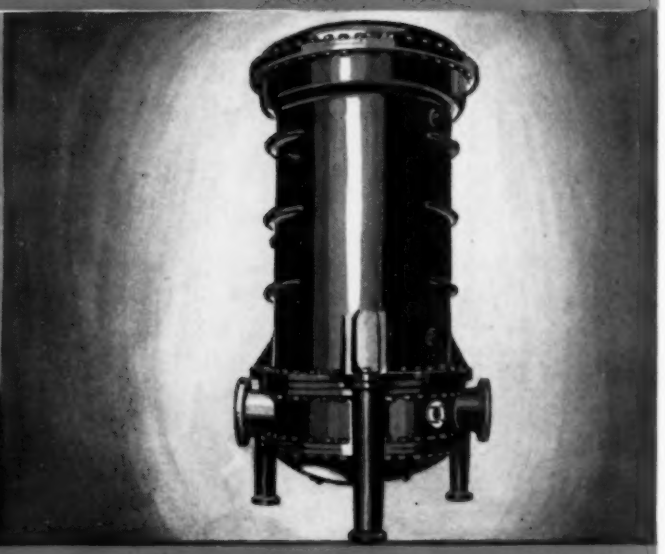


TOUGH! Molybdenum improves the physical properties of iron without increasing the difficulty of machining. Moly-Iron is increasingly used for dies subject to severe strains and abrasion.



WEAR RESISTANT! Moly, even in the low silicon (malleable) irons, greatly increases toughness, strength and wear. One auto maker doubled the life of brake drums with only 0.20% Moly.

HEAT RESISTANT! As with Moly-Steels, Moly-Irons have resistance to growth, distortion and failure at high temperatures. Moly has reduced service failures in parts notoriously troublesome.



CLOSE GRAINED! Moly helps to effect a finely divided pearlite tending to be sorbitic, more stable, more uniformly distributed and covering a larger portion of the whole area.

THE FOUNDRY for June

Industrial RECOVERY

ALL industry is boiling with interest in anticipation of the enactment of the Industrial Recovery act introduced in the Senate May 17 and later in slightly revised form, reported out by the House committee on Ways and Means. This measure promises co-operative action between manufacturers within an industry, to correct abuses and shape economic recovery. Recognition by the government of self-instituted codes of business practice, definite commitment upon matters of wages and hours of work applied through representative trade associations in each industry to deal directly with constituted governmental agencies, are the provisions in broad view. Although the intent is assumed to be largely permissive, the latitude permitted in enforcement is ample and punitive provisions for violation of recognized codes will give pause to deliberate infringement.

Foundries WILL BE READY

THE foundry industry, at least in the ferrous branches, will be ready. Fortunate in the possession of three strong trade associations, and led by far sighted men of the steel, malleable and gray iron sections, a long start has been made in meeting the government half way on the proposed "partnership." In all of the preliminary work, incident to setting up organizations to speak for these three groups, a splendid spirit is evidenced. Those already members of the Gray Iron institute, the Steel Founders' Society of America and the Malleable Iron Research institute have broadly extended the facilities they possess without distinction and on a thoroughly co-operative basis to all manufacturers in their respective classes. Group and sectional meetings have been held to discuss the problems presented and strong committees designated. This will result in a collective viewpoint in each of the three important sections of the foundry industry truly entitled to consideration, when the time arrives, as *representative*, under the most literal interpretation of the law. No attempt will be made to set up codes, nor to take any definite action by agreement, until the proper time arrives, but meantime conferences and correspondence are establishing principles.

Urge United FRONT

THE thought has been advanced that an interchange of viewpoint between the various classes of ferrous foundry interests will prove advantageous. Undoubtedly this is true and if further developments bring about a closer working relationship between steel, gray iron and malleable foundry interests, the value of an united front cannot be overlooked. Many of the business ills which the Industrial Recovery act is designed to cure, are common to all foundries, details of trade practice are similar, questions of wages and hours vary in geographic relationship more than between classes of foundries. Some common meeting ground will be found and the benefit of a strong consolidated industry in point of invested capital, value of product and number of plants, is advisable. If some common interest will permit organization among the far flung and varied brass, bronze and aluminum shops, an association should be set up by the leaders in this group. They, too, could profit by a united front in the foundry industry.

What's New In JUNE

ALL industry, commerce and transportation rests on a cast base, as evidenced at the Century of Progress (page 22). We'll be seein' you at Chicago, June 20 to 23 (page 28 and 33). Follow boards of fireclay in a malleable shop (page 34). Costs important always, imperative today (page 42). What avails a good cost on a poor weight estimate (page 40).

Aerial view of Century of Progress grounds, with the beautiful buildings of Chicago's Loop in the background

A Century's Debt to Castings

A Century of Progress through THE FOUNDRY *greets the American Foundrymen's Association at its convention. It is our faith that the Exposition, with its many exhibits in the marvelous setting provided, will contain much to edify and inspire the members of the foundry industry.*

RUFUS C. DAWES
President, A Century of Progress

A CENTURY OF PROGRESS, official title of the 1933 Chicago World's Fair, may be worn with credit by the castings industry. The foundry art, most venerable of all processes of fabricating metal, is basic to progress recorded in manufacture, commerce and transportation of the past hundred years. Foundrymen who attend the convention of the American Foundrymen's association in Chicago during the week of June 18, will have ample opportunity to view the World's Fair. While the carnival spirit and a stupendous pageant featuring pure visual enjoyment is offered, A Century of Progress will display to serious consideration the drama of the past and an imagination-stirring challenge to the future—the story of castings service.

The displays in the Hall of Science demonstrate the obligation of all industry to basic science. In this debt, the foundries share. Geology, chemistry, mathematics, physics and mechanics, all play a prominent part at some place in the advancement from the mine to the finished casting. Credit is acknowledged with due gratitude, but in compensation, the foundry industry carries a responsibility and discharges its obligation in many fold to humanity through its multitude of services.

Even a brief view of the multitude of different

Interior of the replica of the Golden Pavilion of Jehol, Chinese Lama Temple.

lines of endeavor displayed in profusion at the Chicago World's Fair should convey to the foundry visitor a sense of pride in his craft and industry. Here in Chicago for the second time within the span of a generation the world offers the products of mine, forest, farm and factory and unfolds a panorama of human activity. The older generation reflecting back to 1893 can recall the wonders of the World's Columbian Exposition where Chicago in her new-found power and with full pomp and circumstance set a high mark for accomplishment. Again the opportunity is presented. The spirit of the middlewest in this meeting ground of agriculture, coal, iron, petroleum and transportation has met all promises and ideals.

Replica of Fort Dearborn, one of Chicago's most thrilling historical monuments, reconstructed on the exposition grounds

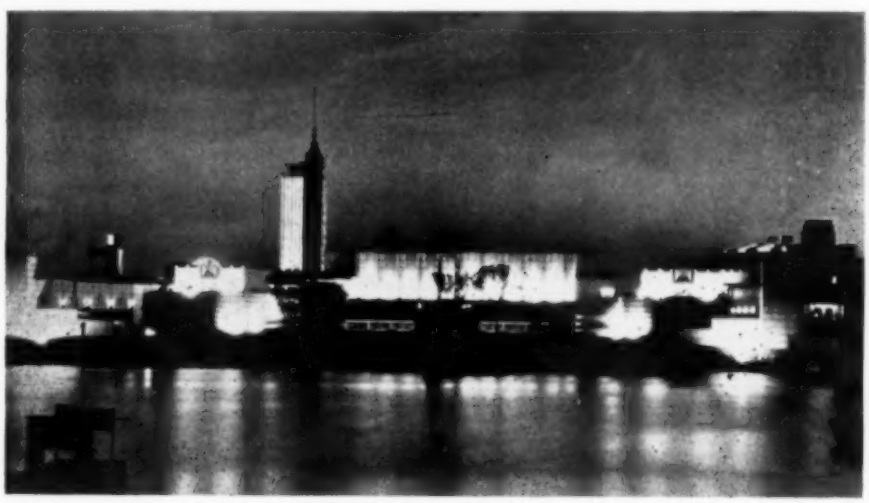
Plays a Leading Part

AT EVERY stage from the inception of the fair idea, the preliminary construction, the erection of a stupendous engineering undertaking and in the final display before the world, the foundry industry has had a definite relationship and has played a leading part. It shows by definite credit entries at every stage the manner in which castings have discharged the debt to science. In speaking of the engineering undertaking involved in setting up this World's Fair, Wayne O. Axtell of the Century department of exhibits, says:

"There is sufficient electrical energy installed in underground conduit systems to take care of the ordinary needs of a city the size of Cincinnati; 10 miles of water main to provide palatable water for the visitor, together with a pumping station with a capacity of 28,000,000 gallons of treated water per day into these mains; 10 miles of piping in the sewage disposal system; almost as much footage of gas mains; a telephone trunk system, which alone cost over $200,000. At the expected peak attendance, structures and services are sufficient to take care of a population of a city the size of Detroit or St. Louis."

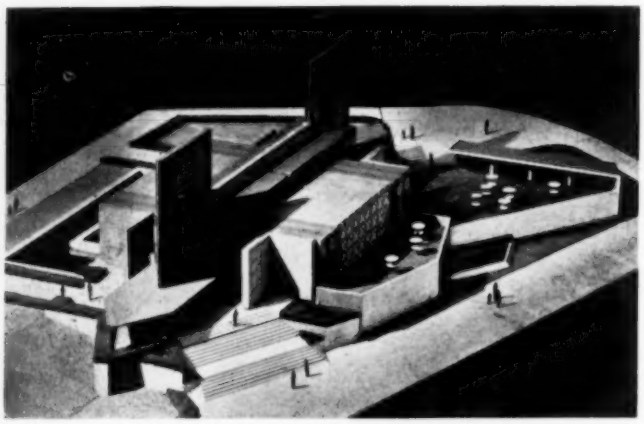
The direct use and application of cast products in the construction phases is evident to all foundrymen. In addition to these, all of the heavy excavating, building and general contractors' equipment, the trucks and other transportation items, involve foundry products.

With the enterprise complete, stretching along the lake front of Chicago on 424 acres of made land, the operating features again bring into relief the service of castings. All of the power, water supply, land water and air transportation facilities employ cast metals. Sixty open trailer type buses operated within the grounds; water craft along the lake front and in the lagoons; air ferry service along the lake front and by amphibian plane to the municipal airport; non-rigid, lighter than air ships at a landing field on the grounds; all these means of conveyance for the visitor within the exposition depend in greater or less degree for their construction and operation upon castings. P. W. Litchfield, president, the Goodyear Tire & Rubber Co., and Goodyear-Zeppelin Corp., builder of the blimps, says:



Night view of the Hall of Science taken from across the lagoon on Northerly Island. Illumination of buildings and grounds at night will be one of the spectacular features of the Fair

"One of the oldest of the industries, the casting of metal into predetermined forms, continues as a fundamental art and craft in the complex mechanical age of today, which the Century of Progress graphically summarizes at Chicago. The rubber industry has



Model of the Time-Fortune building, where current issues of THE FOUNDRY will be found

a thousand uses for it—castings of gray iron, of steel, of brass and of aluminum. And even our affiliated industry at Akron, the building of lighter-than-air craft such as the U. S. S. AKRON and MACON, we found ourselves still turning to the foundrymen for fittings at certain vital points of the ships where great strength and rigidity and lightness of weight were required."

In every feature of the displays at the Fair, the imposing reflection of foundry accomplishment, likewise is shown. Elevators in the two towers of the Sky Ride reaching aloft 100 feet higher than the Washington monument, contain in their cages and motive equipment products from the foundries of the Otis Elevator Co., New York.

Emphasis upon transportation importance in modern life is accented at the Century of Progress. The largest industry of the United States is visualized in all its aspects in the travel and transport building, the main structure unique in modern construction through its suspended, breathing dome roof.

Portray Age of Transportation

IN THIS and its adjacent section will be displayed the history of transportation and the present exemplification of all modes of travel. From the stage coach and prairie schooner days to the auto-gyro era, a complete story is told. Here again the foundryman will see in model, diorama and historic museum treasure the march of transportation in America with cast products constantly in service.

As an example the Baltimore & Ohio Railroad company will show a locomotive built in 1832, motorized to move its queer-looking rods, driven 100 years ago by cast iron pistons in cast iron cylinders. Nearby, a four section car depicting four stages in the advance of passenger car interiors will be shown, while on the tracks without will be the most modern air conditioned train and advanced type locomotive. Close by will be the "Royal Scot" luxurious British train sent by the London Midland & Scottish railway, and the presidential train of the chief executive of Mexico. The Pullman Co., Chicago, commemorates its founder with a car bearing his name. This car employing aluminum to an extent previously unattempted even has its truck cast of solid aluminum.

The transportation group by no means is limited to railway display. The development of air travel is shown and the use of petroleum in every phase of transportation is depicted. The automobile is further demonstrated by individual displays of various manufacturers. While no foundry work is shown in the extensive operating exhibits, cast products will be much in evidence.

The General Motors Corp., Detroit, has a most extensive exhibit, housed within its own buildings, the largest privately constructed structure. Within will be found a complete automobile chassis and body assembly plant, where it is possible to buy a car and see it completely built and rolled out for delivery. The car which is built before the eyes of the Fair visitor contains from 458 to 515 pounds of gray iron and from 63 to 84 pounds of malleable castings in addition to steel, nonferrous and die cast products. Further products of the General Motors Corp., including diesel engines and a variety of miscellaneous commodities made by the 75 companies associated with that organization all draw in some manner upon the foundry industry for manufacture and service.

They Cast Them of Brass

FOUNDRYMEN will find much of interest in the exhibit of the Copper & Brass Research association. Progress of the copper industry for the past 100 years lends itself to a striking graphic presentation. At the beginning of the century the total annual consumption of copper was only about 500 tons, with brass composing about 60 tons. Of this about 75 tons was cast copper and brass in the form of bells, kettles and andirons. Today the normal consumption of copper is more than a million tons and there is hardly a field in which copper alloys do not play a part. The display of the institute will show products of various types of fabrication with a special section devoted to brass and bronze castings.

Mining will be exemplified with the foundry angle shown or evident to those acquainted with modern mechanical production of coal and ores. Modern methods of handling, conveying and transmitting power will be shown graphically by the Link-Belt Co., Chicago in the mineral industries section. Products of the company's foundries are in frequent evidence.

The basic theme of the entire exposition has been held in view in the display of the American Gas association and dynamic action is depicted in the application of gas to many actual processes of fabrication. The first building constructed on the grounds, the administration building in use

during the building of the Fair is gas heated with Bryant boilers and gas is used for cooking, baking and water heating wherever these facilities are in use.

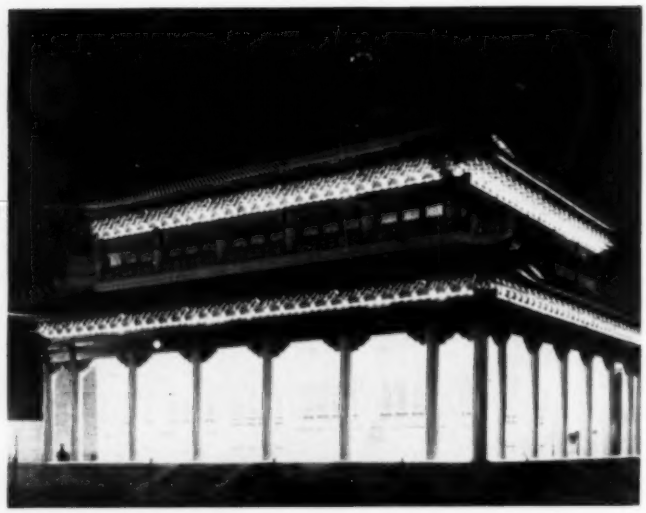
Domestic convenience, modern aids to the science of living, will take new impetus from numerous displays. The Crane Co., Chicago, familiar name in the foundry world, will have extensive displays. In the industrial section of the Electrical building, valves and fittings will be shown, made from gray iron, brass, bronze and steel. In the home planning section bathrooms in the model homes are equipped with fixtures, tubs, and lavatories, of cast iron; showers, faucets, traps and valves of nonferrous metals. In a special building of the Crane company many products which depend upon castings for their form and ability to give years of service demonstrate the truth of the statement made by a Crane official; "Without castings, industry could not function, the sanitation, comfort and health prevalent in the home of today could not exist."

On the comfort angle alone consider the exhibit of the Holland Furnace Co., Holland, Mich. with its heating system involving the use of the "highest grade gray iron" and its new air conditioning unit proudly featuring the bedplate of "durable cast iron on which are mounted two fans with motor between." Probably, the latter also is framed on a quality product of the foundry. The Iron Fireman Mfg. Co., Portland, Oreg., displays a complete line of automatic coal burners and E. C. Sammons, vice president, says, "The products of foundries, both iron and steel castings are properly featured in our line of machines."

Agricultural Service of Castings

NATURALLY, with Chicago the gateway to the great agricultural west, the International Harvester Co., Chicago, is represented prominently. In all the multitudinous mechanical aids to farm and dairy industries, castings naturally are basic. The identification of leading men of that company, employed in its various foundries, with every technical and business activity of industry, evidences the live interest in and depend-

Castings will be found in the manufacturing processes or products of the majority of exhibitors at the Fair. This grouping shows the Goodyear blimps which will operate in Chicago, the display of the Iron Fireman, the beautiful building of General Motors, the new aluminum car of the Pullman Co., General Foods exhibit, the Travel and Transport dome, Copper & Brass Research association display, Sears and Roebuck building and the electrical building



Exterior of the celebrated Chinese Lama Temple as viewed at night. The pavilion was copied faithfully by Chinese, shipped to Chicago in 28,000 pieces and put together like a huge puzzle

ence placed upon castings in all of its many products.

Feminine interests are by no means slighted at the 1933 World's Fair and the contribution of the foundry industry to milady's comfort, pleasure and charm as well as aids to domestic problems will be evident. The Hoover Co., Canton, O., constant advocate of household cleanliness shows products of nonferrous foundries in each sweeper. Phoenix Hosiery Co., Milwaukee, will operate a full-fashioned knitting machine producing 24 stockings at one time. The machine was built in co-operation with the Textile Machine Works, Reading, Pa., and involves many sturdy and exceedingly intricate castings.

Food Products Profusely Shown

FOOD products, many made at the Fair, employ countless castings. Domestic aids in the production and preservation of foods give another slant on the foundries contribution. In mason jars, the glass containers for home canned foods, foundry products, perform a valuable, though often unknown function. The exhibit planned by Ball Brothers Co., Muncie, Ind., is extensive and will embrace the best examples of canned food selected from 35,000 exhibited in an International Canning Contest in 1932. As for the service of foundry products in producing the jars shown, Frank E. Ball says;

"The scientific study made by the foundry industry to produce castings that will stand up under the difficult demands of blow molds, press molds, bottom plates and plungers which come into contact with glass at a temperature of 2100 degrees, has resulted in better castings. Perhaps this is one bit of progress which may be credited to the low economic plane of the past three years. In ordinary times, the foundry industry does not get excited about business from the glass industry. During the past three years, when orders were not easy to get, there were some members of the glass industry that enjoyed reasonably heavy operations. Competition for this business resulted in castings so much improved that now it would be difficult to consider making glass containers with castings of the quality generally used prior to 1929."

The unlimited wonders of the World's Fair might be cited indefinitely and the debt of each group and individual exhibit feature to castings could be delineated. In printing with the Goss Printing Press Co. new high-speed newspaper press delivering and counting 60,000 newspapers an hour and involving in its construction more than 50 per cent by weight of cast materials; machine tools such as those built by the Armstrong Brothers Tool Co., Chicago; innumerable individual items handled by the Sears Roebuck Co., who have a large building at the Fair; even the finest microscopes and optical instruments built by Bausch & Lomb, Rochester, N. Y.; testing machines from Tinius Olson Testing Machine Co., Philadelphia; watches and fine time-measuring equipment such as is made by the Elgin National Watch Co. The background of foundry service is evident at many other points along the advancing line of manufacture.

Briefly, a few of the representative types of exhibits have been scanned through foundrymen's spectacles. Past and present accomplishments have predominated. But the future by no means is neglected. Perhaps the most far reaching array of exhibits (*Conclude on page* 88)

Tower and court for the beautiful Hall of Science. The court, enclosed on three sides and with the lagoon on the fourth, can accommodate 80,000 persons

The Foundry Views the 1893 Fair

Files of initial year reflect trends and opinions during the Columbian Exposition

IN THE June 1893 issue of THE FOUNDRY and therefore in the tenth month of this publication's existence, the editor returning from a visit to the World's Fair, the Columbian Exposition in Chicago, urges his readers to go and do likewise. Under the heading *Go and See It* he comments in enthusiastic fashion:

It is a magnificent, stupendous success. Nothing that has been said, written, thought, imagined or dreamed of can ever do it justice. Unquestionably it is the greatest achievement of its kind in modern times and only those who do not see it will be sorry. To the thousands of those who are in doubt as to whether they will go there or not we would earnestly say GO. * * * * * * * The opportunity is not likely to be your's again. It will elevate, educate, broaden your ideas. No person is too busy. If you had but 30 days to live, you could not devote the time to better advantage in preparing for the next world, than in viewing all that is best and grandest in this. GO.

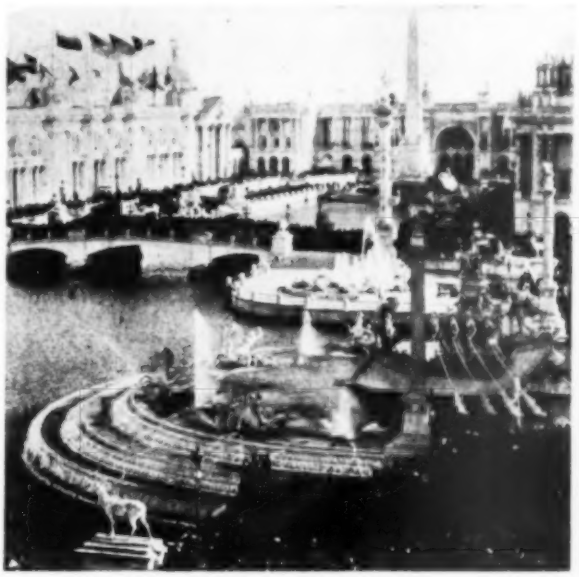
Thousands Attend Daily

Nothing lukewarm about that advice. Elsewhere the statement is made that the daily paid admission to the fair was 100,000. In this connection also it is interesting to note that the Chicago World's Fair of 1893 was staged during one of the periodical panics, or periods of financal stringency, into which the United States regularly is plunged and from which it emerges regularly to new achievement. Is there not something familiar about the following excerpts taken from the Sept. 1893 issue:

There exists no serious, deeply laid reason for all this financial unrest and stopping of the wheels of trade. Perhaps we may have a little over production, too much trade and an unwarranted extension of credit, which at least will be checked temporarily if not stopped permanently by the halt which has been called. Really we are better off than we were before. ****** As soon as our present fears wear off and the demand for profitable investment compels the timid ones (hoarder is the 1933 term) to unlock their treasures—as they soon must—the wheels of commerce will commence to revolve with increasing velocity ******* The people are aroused and the beauty of this thing is that they are getting a degree of education on matters of national finance which nothing else could give them. As a result they are not in a mood to stand any trifling. They want relief and they want it quickly. While innumerable plans have been proposed, in the main the people are indifferent which is adopted so long as the desired result is obtained.

Human nature alone is static in the changing cycle of time. Before this issue of THE FOUNDRY reaches our readers, the backbone of the money famine will be broken and the people who entered into combination to corner the money market will have discovered that they have failed and will commence to re-invest. It will be some time before the business of the country resumes a normal tone, but the worst of the trouble is far in the rear. A rapid improvement in both cause and effect is steadily noticeable. Let us all congratulate ourselves that the business interests begin to breathe easier, that in the first place it was not worse and in the second place that many important lessons have been learned that may benefit us all in the future.

In another issue of THE FOUNDRY the editor declares that "The Fair is greater, grander and more magnificent and more instructive than lies in the power of man to imagine without going there. Newspapers criticising it, particularly in eastern cities, do so because their editors are troubled with bilious- (*Please turn to page* 76)



Tremendous crowds attended the World's Fair in Chicago 40 years ago. Illustration courtesy Westinghouse Electric & Mfg. Co.

Stevens hotel, headquarters for the convention and scene of the exhibit

A. F. A. Meeting Offers Opportunity

March of progress in all phases of the industry will be revealed at convention

CIVILIZATION has made greater strides during the past century than in any similar period in all the history of mankind. Progress exemplified in every human activity has eased the burdens of men and women. Science and invention have brought more time for leisure and recreation, and raised the standard of living far beyond the dreams of the sturdy pioneers who laid the foundations of our country. The educational exhibits at the Chicago World's Fair this year visualize man's major achievements industrially, in the past hundred years.

While this period also has provided the greatest development in the application of castings in the service of the race, it has been only within the last 40 years that a real industry consciousness has been developed and the most remarkable progress has been made in the application of castings as engineering materials. Of the several agencies that have worked unceasingly to place castings upon the high pinnacle of popular acceptance and appreciation as marked by the present attention of the engineering profession, the American Foundrymen's association, with its annual technical convention and the exhibition of foundry equipment and supplies has performed a service of vital importance to the foundry industry, as well as to the men and women everywhere who find their daily lives surrounded by the products of the foundry industry.

Of all conventions in recent years, the meeting in Chicago, to be held at the Stevens Hotel, June 20 to 26, probaby offers the highest opportunity for profit to the association members and visitors attending. The late depression has wrought changes marked in many phases of industrial endeavor, and not the least is that found in castings production. In technical

thought, production methods, selling procedure and equipment for consummating the work of the industry, the march of progress continues. Each of these phases will be presented in review during Foundrymen's week in Chicago.

Technical sessions will cover important problems and the newer developments in the fields of steel founding, nonferrous metals, malleable iron and gray iron. Foundry sands, good housekeeping, materials handling, foundry costs and power costs will feature various discussions throughout the week. In addition the shop courses, so popular among A. F. A. convention visitors since their introduction several years ago, will provide the vehicle for the informal discussion of fundamental practical problems. As may be noted from a study of the program presented in the accompanying table, the technical program this year has been exceptionally well arranged, with sufficient time provided to inspect carefully the exhibits of foundry equipment and supplies in the Exhibition hall of the Stevens Hotel. Opportunity is afforded to visit the Century of Progress, opened officially on May 27 with thousands of people in attendance, and which will be in full operation during the foundry convention.

Talk Over the Power

WHILE the A. F. A. convention will not open officially until Tuesday, a conference on electric power costs will be held on Monday, June 19, under the auspices of a committee cooperating with the Gray Iron institute, the Malleable Iron Research institute and the Steel Founders' Society of America. This committee recently sent questionnaires to firms using electric furnaces for melting metal, with the idea of securing data on comparative costs of power. The returns of the survey will be presented at the conference and various phases of power costs will be discussed.

The shop courses, so successful during the past few years as a forum for the discussion of practical foundry problems, will be continued during the Chicago meeting. Two sessions will be featured at 8:30 each morning, one devoted to various problèms pertaining to foundry sand and the other to cast iron. Sand sessions will consider application of sand control methods to continuous and jobbing foundries; sand classification; and sand control. Gray iron subjects include the consideration of small cupolas and their operation; gating terms; iron structures and alloy cast iron.

Few features on the program of events probably will present a more interesting and vital message than the joint luncheon of the Foundry Equipment Manufacturers' association and the American Foundrymen's association to be held on Tuesday noon at the Stevens hotel. Fred W. Sargent, president of the Chicago & North Western railroad and a crusader for economy in government, will speak on "Business and Politics." This important luncheon will be open to all convention visitors.

Cleaning Up for Health's Sake

THE A. F. A., National Safety council and National Founders' association are sponsoring a conference on "Foundry Housekeeping and the Dust Problem," with the idea of providing foundrymen with clear, authoritative information on various phases of the dust problem. Dr. E. G. Meiter, director, Industrial Hygiene laboratory, Employers Mutual Liability Insurance Co., Milwaukee, will talk on "The Dust Problem as it Relates to the Foundry Industry"; and A. D. Lynch, personnel director, Ohio Brass Co., Mansfield, O., will stress the enlistment of the interest of the foreman and worker in maintaining a clean and orderly foundry. Other authorities also will discuss various factors connected with good housekeeping methods.

The drama will enter the convention on Tuesday afternoon when a complete four-act play will be presented by a cast of 20, all identified with the foundry industry. The play, "Rebuilding for Profits," will dramatize a foundry's experience with cost methods under present day conditions. Some of the leading talent of the A. F. A. has been active in writing and rehearsing this play. A. E. Grover, cost advisor, Gray Iron Institute wrote the play and production is directed by the cost committee, of which J. L. Wick, Falcon Bronze Co., Youngstown, is chairman.

Chicago has many points of interest to the convention visitor. This view shows the Chicago river, one of the many beautiful bridges, and several skyscrapers in the background

The nonferrous division has prepared a symposium on "Deoxidization and Degasification of Bronze Foundry Alloys," which will cover valve bronzes (85-5-5-5 type); leaded bearing bronzes (80-10-10 type); and tin bronzes (88-11 type). Development of the symposium was directed by T. E. Kihlgren, International Nickel Co., Bayonne, N. J. and C. H. Lorig, Battelle Memorial institute, Columbus, O. The nonferrous division also is sponsoring a technical session on Wednesday morning to be followed by a round table at noon. Papers to be presented at the technical session include "Effects of Small Additions of Aluminum, Silicon and Phosphorus to a Leaded Bronze" by H. J. Roast, McGill University, Montreal: "A Study of Six Bearing Metals" by O. E. Harder, Battelle Memorial institute and C. S. Cole, Copper & Brass Research association, New York; and "Berylllium-Copper Castings" by E. F. Cone, New York.

A SYMPOSIUM on "Alloys in Steel Castings" will feature the program on steel founding problems arranged by the steel division of the A. F. A. Four alloys and their relation to steel casting will be discussed at the meeting to be held Wednesday morning. H. W. Gillett and J. L. Gregg, Battelle Memorial institute, will discuss molybdenum; J. H. Critchett, Union Carbide & Carbon Co., New York, will talk on chromium; A. G. Zima, International Nickel Co., New York, will present data on nickel; and Jerome Strauss, Vanadium Corp. of America, Bridgeville, Pa., will talk on vanadium. A round table luncheon for the steel group following the morning session will feature a paper "Coreless Induction Furnace Operation" by W. E. McKibben, General Electric Co., Schnectady, N. Y., and committee reports on specifications, classification of steel castings, and phosphorus and sulphur effects in steel castings.

Session Schedule For Convention Week

Monday, June 19

Committee Meetings

2:00 p.m.—Conference on Electric Power Costs

Tuesday, June 20

8:30 a.m.—Registration
Shop Courses

9:00 a.m.—Exhibition Opens

10:00 a.m.—Formal opening of Convention

10:30 a.m.—Foundry Sands

12:30 p.m.—Joint A.F.A. and F.E.M.A. Luncheon

2:00 p.m.—Foundry Costs

Wednesday, June 21

8:30 a.m.—Exhibition Opens
Shop Courses

10:00 a.m.—Cast Iron—Melting
Steel Founding—Alloys in Steel Castings
Nonferrous Metals
Malleable Iron

12:30 p.m.—Roundtable Luncheon Conferences
Steel
Malleable Iron
Nonferrous Founding

Thursday, June 22

8:30 a.m.—Exhibition Opens
Shop Courses

10:00 a.m.—Steel Founding
Cast Iron
Nonferrous Metals

2:00 p.m.—Business Meeting

2:30 p.m.—Foundry Housekeeping—Joint Meeting of A.F.A., National Safety Council and National Founders' Assn.

Friday, June 23

8:30 a.m.—Exhibition Opens
Shop Courses

10:00 a.m.—Cast Iron Tests and Specifications—Joint Meeting with A.S.T.M.
Materials Handling — Joint Meeting with Materials Handling Division of American Society of Mechanical Engineers

12:30 p.m.—Conference on Apprentice Training

2:00 p.m.—Conference on Foundry Education in Engineering Schools

Monday morning, June 26

Symposium on Cast Iron—American Society for Testing Materials, Hotel Stevens

Tuesday morning, June 27

Foundry Practice — American Society of Mechanical Engineers.

Three discussions of considerable interest will be presented at the steel founding session on Thursday morning. Fred Grotts, Continental Roll & Steel Foundry Co., East Chicago, Ind., will show the importance of impact tests in determining the dynamic properties of steel castings. C. W. Briggs and R. A. Gezelius, who have been conducting researches on steel castings at the Naval Research laboratory, Anacostia, D. C. will present data on solidification and contraction and their relation to the formation of hot tears in steel castings. H. R. Isenburger, St. John X-Ray Corp., New York, will discuss the application of radiographic inspection of castings.

CAST iron will be considered on three programs during the A. F. A. meeting and will be discussed as a part of the technical program of two other engineering association meetings the following week. The first cast iron session, to be held on Wednesday, will be devoted to melting problems, and will include the following papers: "Practical Experience with Electric Furnace Iron" by C. L. Frear, DeLaval Separator Co., Poughkeepsie, N. Y.; "Experience of a Gray Iron Jobbing Foundry with a Rocking Type Electric Furnace," by C. R. Culling, Carondelet Foundry Co., St. Louis; "Air Furnace Cast Iron," by D. P. Forbes, Gunite Corp., Rockford, Ill.; and "Properties of Gray Cast Iron as Affected by Casting Conditions," by C. M. Saeger Jr. and E. J. Ash, bureau of standards, Washington.

The annual exchange paper of the Institute of British Foundrymen entitled "Sea Coal Effects on Sands," by Ben Hird, will be presented at the cast iron session on Thursday morning. Other papers will include "Effects of Slag on Cu-

Program of Technical Papers For Chicago Meetings

Monday, June 19

Committee Meetings.

2:00 p.m.—Conference on Electric Power Costs.

Chairman, J. R. Allan, International Harvester Co., Chicago.
Steel Founders' Society of America, Gray Iron Institute, and Malleable Iron Research Institute co-operating.

Tuesday, June 20

8:30 a.m.—Registration.

8:30 a.m.—Shop Courses.

(a) Sand—Application of Control Method to Continuous and Jobbing Foundries.
(b) Cast Iron—Small Cupolas and Their Operation.

9:00 a.m.—Exhibits open.

The exhibit will be open from 8:30 a. m. to 5:00 p. m. on each day of the convention after Tuesday.

10:00 a.m.—Formal opening of Convention.

Chairman, President Hammond, and vice chairman, Vice President Lanahan.
President's Address.

10:30 a.m.—Foundry Sands.

Chairman, R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston.
Application of Sand Testing by the Producer, by C. M. Hardy, Houghland & Hardy, Evansville, Ind.
Grain Structure Effect on Mold Permeability Control, by H. W. Dietert and F. Valtier, Detroit.
Effects of Silt on the Bonding Strength of Clay, by Dr. H. Ries, Cornell university, Ithaca, N. Y.

12:30 p.m.—A. F. A. and F. E. M. A. Joint Luncheon.

Speaker—Fred Sargent, President, Chicago & North Western railroad.

2:00 p.m.—Foundry Costs.

"Building for Profits," a dramatization of a foundry's experience with cost methods.

Wednesday, June 21

8:30 a.m.—Shop Courses.

(a) Sand—Classification.
(b) Cast Iron—Gating Terms.

10:00 a.m.—Cast Iron—Melting.

Chairman, J. W. Bolton, Lunkenheimer Co., Cincinnati; vice chairman, Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.
Practical Experience with Electric Furnace Iron, by C. L. Frear, DeLaval Separator Co., Poughkeepsie, N. Y.
The Experience of a Gray Iron Jobbing Foundry with the Rocking-Type Electric Furnace, by C. R. Culling, Carondelet Foundry Co., St. Louis.
Air Furnace Cast Iron, by D. P. Forbes, Gunite Corp., Rockford, Ill.
Properties of Gray Cast Iron as Affected by Casting Conditions, by C. M. Saeger Jr., and E. J. Ash, Bureau of Standards Washington.

10:00 a.m.—Steel Founding—Alloys in Steel Castings.

Chairman, R. A. Bull, Electric Steel Founders' Research group, Chicago; vice chairman, W. C. Hamilton, American Steel Foundries, East Chicago, Ind.
Molybdenum, by H. W. Gillett and J. L. Gregg, Battelle Memorial Institute, Columbus, O.
Chromium, by J. H. Critchett, Union Carbide & Carbon Co., New York, N. Y.
Nickel, by A. G. Zima, International Nickel Co., New York, N. Y.
Vanadium by Jerome Strauss, Vanadium Corp. of America, Bridgeville, Pa.

10:00 a.m.—Nonferrous Metals.

Chairman, Sam Tour, Lucius Pitkin Inc., New York; vice chairman, Jerome Strauss, Vanadium Corp. of America, Bridgeville, Pa.
Effects of Small Additions of Aluminum, Silicon and Phosphorus to a Leaded Bronze, by H. J. Roast, McGill university, Montreal.
A Study of Six Bearing Metals, by O. E. Harder, Battelle Memorial institute, Columbus, O., and C. S. Cole, Copper & Brass Research association, New York.
Beryllium-Copper Castings, by E. F. Cone, New York.

10:00 a.m.—Malleable Iron.

Chairman, F. L. Wolf, Ohio Brass Co., Mansfield, O.; vice chairman, E. E. Griest, Chicago Railway Equipment Co., Chicago.
Sand Control on a Continuous Molding System, by Charles Morrison, Saginaw Malleable Iron division, General Motors Corp., Saginaw, Mich.
Effects of Superheat on the Annealing of Malleable Iron, by A. E. White and R. Scheidewind, University of Michigan, Ann Arbor, Mich.
High-Strength Wear-Resistant Malleable Iron, by Rebecca Hall, Chicago.

12:30 p.m.—Round Table Luncheon Conference.

(a) Steel
Chairman, P. E. McKinney, Bethlehem Steel Co., Bethlehem, Pa.; vice chairman, F. A. Melmoth, Detroit Steel Casting Co., Detroit.
Coreless Induction Furnace operation, by W. E. McKibben, General Electric Co., Schenectady, N. Y.
Report of Committee on Specifications.
Report of Committee on Classification of Steels for Castings.
Report of Representative on Joint Committee on Effect of Phosphorus and Sulphur in Steel.
(b) Malleable Iron.
Chairman, J. H. Lansing, Danville Malleable Iron Division, Allith Prouty Co., Danville, Ill.; vice chairman, H. W. Highriter, Frazier & Jones Co., Syracuse, N. Y.
(c) Nonferrous Founding.
Chairman, H. M. St. John, Detroit Lubricator Co., Detroit.

Thursday, June 22

8:30 a.m.—Shop Courses.

(a) Sand—Control.
(b) Cast Iron—Structures.

10:00 a.m.—Steel Founding.

Chairman, John Howe Hall, Taylor Wharton Iron & Steel Co., High Bridge, N. J.; vice chairman, George Batty, Steel Castings Development bureau, Norberth, Pa.
Studies on Solidification and Contraction and Their Relation to the Formation of Hot Tears in Steel Castings, by C. W. Briggs and R. A. Gezelius, Naval Research laboratory, Washington.
Dynamic Properties of Steel Castings as Determined by the Impact Test, by Fred Grotts, Continental Roll & Steel Foundry Co., East Chicago, Ind.
Advantages to Foundrymen of Radiographic Inspection, by H. R. Isenburger, St. John X-Ray Corp., New York.

10:00 a.m.—Cast Iron.

Chairman, J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham; vice chairman, B. S. MacPherran, Allis Chalmers Mfg. Co., Milwaukee.
Sea Coal Effects on Sands, by Ben Hird, Institute of British Foundrymen.
Effects of Slag on Cupola Operation and Metal Structure, by R. H. Bancroft and A. C. Myers, Perfect Circle Co., New Castle, Ind.
Titanium in Cast Iron, by G. F. Comstock, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
High Silicon Heat Resisting Cast Iron, by A. L. Norbury and H. H. Morgan, British Cast Iron Research association, Birmingham, England.
Martensitic Quenching of Cast Iron, by M. Delbart, French Foundry Technical association.
Low-Silicon Medium-Carbon Gray Cast Irons, by A. H. Dierker, Ohio State university, Columbus, O.

10:00 a.m.—Nonferrous Metals.

Symposium on Deoxidization and Degasification of Bronze Foundry Alloys
Chairman, T. E. Kihlgren, International Nickel Co., Bayonne, N. J.; vice chairman, C. H. Lorig, Battelle Memorial institute, Columbus, O.
Alloy Group 1—Valve Bronzes (85-5-5-5 type)
Alloy Group 2—Leaded Bearing Bronzes (80-10-10 type).
Alloy Group 3—Tin Bronzes (88-11 type).

2:00 p.m.—Business Meeting.

Chairman, President T. S. Hammond; vice chairman, Vice President Frank J. Lanahan.

2:30 p.m.—Foundry Housekeeping.

Joint Meeting A. F. A., National Safety Council and National Founders' association
Chairman, President T. S. Hammond.

(Concluded on Page 32)

pola Operation and Metal Structure," by R. H. Bancroft and A. C. Myers, Perfect Circle Co., New Castle, Ind.; "Titanium in Cast Iron," by G. F. Comstock, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.; "High-silicon, Heat-Resisting Cast Iron," by A. L. Norbury and H. H. Morgan, British Cast Iron Research association, Birmingham, England; "Martensitic Quenching of Cast Iron," by M. Delhart, French Foundry Technical association, Paris, France; and "Low-Silicon, Medium-Carbon Gray Cast Irons," by A. H. Dierker, Ohio State university, Columbus, O.

A joint meeting of the A. F. A. and the American Society for Testing Materials will be held Friday morning, June 16, and will be devoted to a discussion of tests and specifications. H. Bornstein, Deere & Co., Moline, Ill. and chairman of A. S. T. M. committee A-3, will present the introduction and discuss "Significance of Testing Cast Iron and Limitations of Testing." R. S. MacPherran, Allis-Chalmers Mfg. Co., Milwaukee, will present data on "Correlation of Test Bar and Casting," and "Transverse and Tensile Tests, Modulus of Elasticity, Fatigue and Impact Tests." John W. Bolton, Lunkenheimer Co., Cincinnati, will discuss "A. S. T. M. Specification A48-32T"; J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, will talk on "Mechanism of Testing" and "Factors in Production of Test Bars"; and A. L. Boegehold, General Motors Corp., Detroit will discuss "Value of Hardness Testing for Control of Product" and "Wear and Machinability Tests."

A symposium on cast iron, a splendid piece of work carrying all of the latest available data on that subject, will be presented on Monday morning, June 26, as a part of the program of the American Society for Testing Materials. This work is presented under the joint sponsorship of the A. S. T. M. and the A. F. A., and represents the third of a series covering cast materials. On Tuesday morning, June 27, the American Society of Mechanical Engineers, will hold a session on foundry practice when the following papers will be presented: "Engineering Cast Irons" by Oliver Smalley and W. W. Kerlin, Gray Iron institute, Cleveland; and "Electric Furnace Cast Iron," by H. H. Walther, Dayton Steel Foundry Co., Dayton, O.

Program of Technical Papers For Chicago Meetings

(*Concluded from Page* 31)

The Dust Problem in the Foundry Industry, by Dr. E. G. Meiter, Employers Mutual Liability Insurance Co., Milwaukee.
Enlistment of Foremen's and Workers' Interest in Keeping a Clean and Orderly Foundry, by A. D. Lynch, Ohio Brass Co., Mansfield, O.

Friday, June 23

8:30 a.m.—Shop Courses.

(a) Sand Control.
(b) Alloy Cast Iron.

10:00 a.m.—Cast Iron Tests and Specifications.

Joint Meeting with A. S. T. M.
Chairman, H. Bornstein, Deere & Co., Moline, Ill.; co-chairman, representing A. S. T. M., J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.
(a) Introduction, by H. Bornstein, Chairman A. S. T. M. Committee A-3 and A. F. A. Cast Iron Division, Chief Chemist, Deere & Co., Moline, Ill.
(b) Significance of Testing Cast Iron and Limitations of Testing, by H. Bornstein.
(c) Correlation of Test Bar and Casting, by R. S. MacPherran, Allis Chalmers Mfg Co., Milwaukee.
(d) Transverse and Tensile Tests, Modulus of Elasticity, Fatigue and Impact Tests, by R. S. MacPherran.
(e) A. S. T. M. Specification A48-32T, by J. W. Bolton, Lunkenheimer Co., Cincinnati.
(f) Mechanism of Testing, by J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.
(g) Factors in Production of Test Bars, by J. T. MacKenzie.
(h) Value of Hardness Testing for Control of Product, by A. L. Boegehold, General Motors Corp., Detroit.
(i) Wear and Machinability Tests, by A. L. Boegehold.

10:00 a.m.—Materials Handling.

Joint Meeting with Materials Handling Division of American Society of Mechanical Engineers.
Chairman, O. D. Conover, Cleveland; co-chairman, representing A. S. M. E., Jervis B. Webb, Jervis B. Webb Co., Detroit.
Field of Materials Handling in Small Foundries, by Max Amos and R. W. Grace, Standard Automotive Parts Co., Muskegon, Mich.
Field of Materials Handling in Semiproduction Foundry, by R. G. Wielland, Forest City Foundries Co. Cleveland.

12:30 p.m.—Conference on Apprentice Training.

2:00 p.m.—Conference on Foundry Education in Engineering Schools.

Monday morning, June 26

Symposium on Cast Iron.

American Society for Testing Materials, Hotel Stevens.

Tuesday morning, June 27

Foundry Practice

American Society of Mechanical Engineers.
Engineering Cast Irons, by O. Smalley and W. W. Kerlin, Gray Iron institute, Cleveland.
Electric Furnace Cast Iron, by H. H. Walther, Dayton Steel Foundry Co., Dayton, O.

Consider Malleable Problems

THE session on malleable iron on Wednesday morning will feature three papers as follows: "Sand Control on a Continuous Molding System," by Charles Morrison, Saginaw Malleable Iron division, General Motors Corp., Saginaw, Mich.; "The Effects of Superheat on the Annealing of Malleable Iron" by A. E. White and R. Schneidewind, University of Michigan, Ann Arbor, Mich.; and "High-Strength, Wear-Resistant Malleable Iron" by Rebecca Hall, Chicago. A round table discussion on malleable founding will follow the technical session.

A session on foundry sands on Tuesday morning will be devoted to three papers on "Application of Sand Testing by the Producer" by C. M. Hardy, Houghland & Hardy, Evansville, Ind.; "Grain Structure Effect on Mold Permeability Control," by Harry W. Dietert and F. Valtier, U. S. Radiator Corp., Detroit; and "Effects of Silt on the Bonding Strength of Clay" by Dr. H. Ries, Cornell university, Ithaca, N. Y.

A. F. A. also will hold a joint meeting with the Materials Handling division of the American Society of Mechanical Engineers on Friday morning, June 16. Max Amos and R. W. Grace, Standard Automobile Parts Co., Muskegon, Mich. will present a paper on "The Field of Materials Handling in Small Foundries" and R. G. Wielland, Forest (*Please turn to page* 69)

New Equipment To Feature Show

Manufacturers of machines and supplies will exhibit products for first time at Chicago

THE exhibition of foundry equipment and supplies to be held in the Stevens hotel, Chicago, June 20 to 23, opens at a time when business in general is staging a remarkable recovery from the low point of the depression occurring earlier in the year. With foundry operations showing a substantial increase in many quarters, and with recognized business trend indicators, such as steel mill operations, freight car loadings, electric power consumption, retail sales and many others, jumping to the highest point in from 12 to 24 months, foundrymen are in a position again to give attention to production problems, to investigate methods and equipment which will permit the production of a better product at a lower cost. Opportunity for such a study is offered in the Foundry and Industrial exposition.

Foundry Industry Will Benefit

Remarkable progress has been made during the past three years in developing new equipment and in perfecting machines that in the past have given good service to the industry. Research and engineering departments have been busy investigating the problems and transferring the results of these studies to the drafting board and hence to the finished machine. Experimental tests have followed, any difficulties have been ironed out and finally the machine has been considered ready for application to the particular job for which it was intended. While this is a long and often times costly process, the fact that so many companies have been willing to spend both time and money in a period of business recession indicates the willingness of the manufactures of foundry equipment and supplies to be of greatest service to the foundry industry.

The large amount of research and development work which has been under way only recently has become apparent. A variety of new equipment and supplies has been announced in recent months through THE FOUNDRY. A survey of exhibitors indicates that a number of manufacturers have held back their contributions to production efficiency for unveiling at the coming show. Still others, with new machines well along the road to completion, will be at the convention to point out the possibilities of their developments, with an announcement of complete details following shortly.

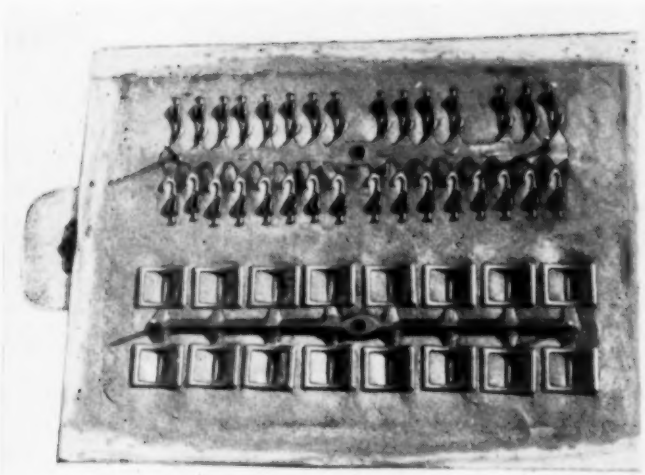
In scanning the material to be exhibited at the Chicago show, THE FOUNDRY has found something new in practically every field. This is especially true in molding, core making, sand preparing and reclaiming, melting, cleaning, and annealing. In addition, new flasks, temperature indicating and recording equipment, safety equipment, core oils, pattern mounting, and metals will command attention.

New and improved molding machines will be shown by a number of manufacturers. Production possibilities of the core blowing machine will provide considerable interest at the show with several new types of machines on display at an A. F. A. exhibit for the first time. An entirely new principle in cleaning castings in which the abrasive is thrown by centrifugal action against the work, will be shown and its application to existing blasting units will be explained. Another new device consists of a tubular type dust collector, in which the tubes may be replaced quickly and the shaking device is simple and effective.

Increase Efficiency of Sand Machines

One company will feature a new sand mixer of the muller type, which is equipped with antifriction bearings, and has a new style of plow beam and plows which are claimed to make the machine more efficient. The mullers are offset to increase the angle of slip and therefore increase the mulling action, and a simplified lubrication system is provided. An entirely enclosed vibrating screen for reclaiming sand will be shown for the first time.

In line with changing demands on equipment, one company will display a new type of air compressor which will provide sufficient air to operate 25 molding machines. The machine is claimed to be economical in plants where sandblasting equipment is not operated. Another display will feature a car (*Please turn to page* 69)



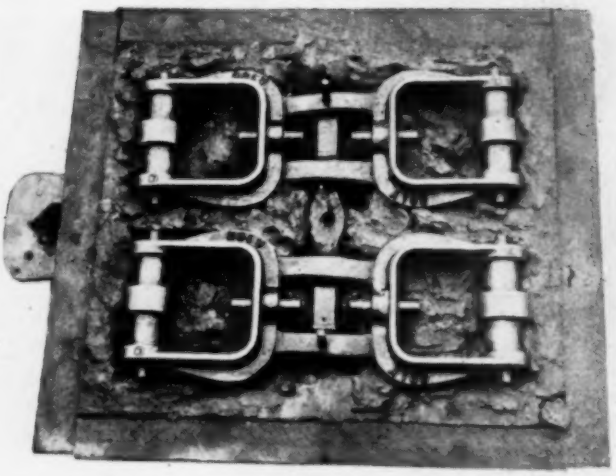


Fig. 1—(Left)—The moistened clay lends itself readily to the formation of small, intricate or larger plain joints. Fig. 2—(Right)—The patterns first are bedded in place

Fire Clay for Follow Boards

This material is adaptable particularly to gates of small and intricate patterns

BY PAT DWYER

ONE of the oldest devices in the foundry for increasing production and one that still is used extensively is the follow board, also known colloquially in many places as a fallow board, an odd side, a match, a match-plate, a sand match, a plaster match or a false cope. Local custom has perpetuated any one of these terms in any given locality, while some of the terms of course are based on the material composing the device. As with many other terms employed loosely in the foundry, this group of terms referring to a follow board is synonomous and interchangeable.

Takes Place of Rollover Board

The device is designed to take the place of the rollover board and is particularly applicable to single patterns or groups of small patterns requiring an irregular parting line. Where a pattern or group of patterns of this kind is placed upon a flat board and rolled over in a drag, a considerable amount of time is consumed in removing the surplus sand and in forming the irregular parting surface. Manifestly where the operation has to be repeated on every mold made during the day, the amount of time consumed amounts to quite an item. The follow

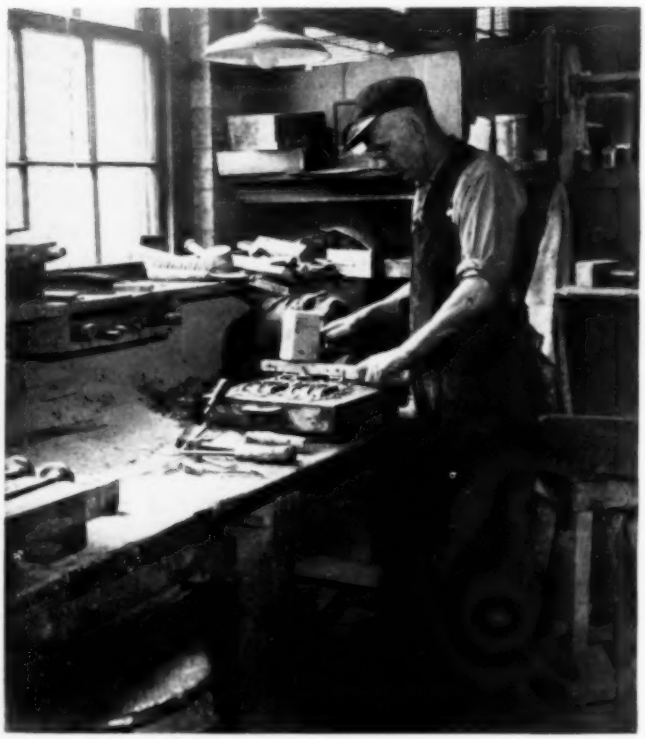


Fig. 3—The operator raps the pattern down into the soft clay

board automatically forms the parting surface on the drag and in that manner relieves the molder of the necessity of doing that amount of work.

A wood composition or metal matchplate for use either on the bench or on a molding machine, performs the same function. Any one of various reasons may lead a foundryman to choose a follow board of any material in preference to a matchplate, or vice versa. These reasons usually hinge on local conditions, available equipment, extent of an order, etc., and lie outside the scope of the present article, a brief description of the methods and material employed for many years in the construction of fire clay follow boards at the plant of the Eberhard Mfg. Co., Cleveland.

Started on Harness Hardware

In recent years the Eberhard Co. has engaged to some extent in the production of miscellaneous malleable iron castings, automobile, railroad and marine hardware, but its principal outlets still are the saddlery, harness and vehicular hardware fields, fields in which the company has specialized and catered to a world wide trade since its inception over 50 years ago. Typical groups of patterns, also the general features of the follow boards on which they are mounted are shown in several of the accompanying illustrations.

In some respects the fire clay follow board resembles a soft or green sand match. That is a follow board formed by ramming green sand in a frame. This device usually is employed only where a few duplicate molds are required. It is referred to here to distinguish it from the much more substantial hard sand match, a frame rammed full of a mixture containing sand, linseed oil and litharge. The hard sand match becomes dry and hard and will withstand extended service. In this respect, for purpose of classification, the hard sand match may be listed with compounds, proprietary and otherwise, employed in the foundry for the same purpose.

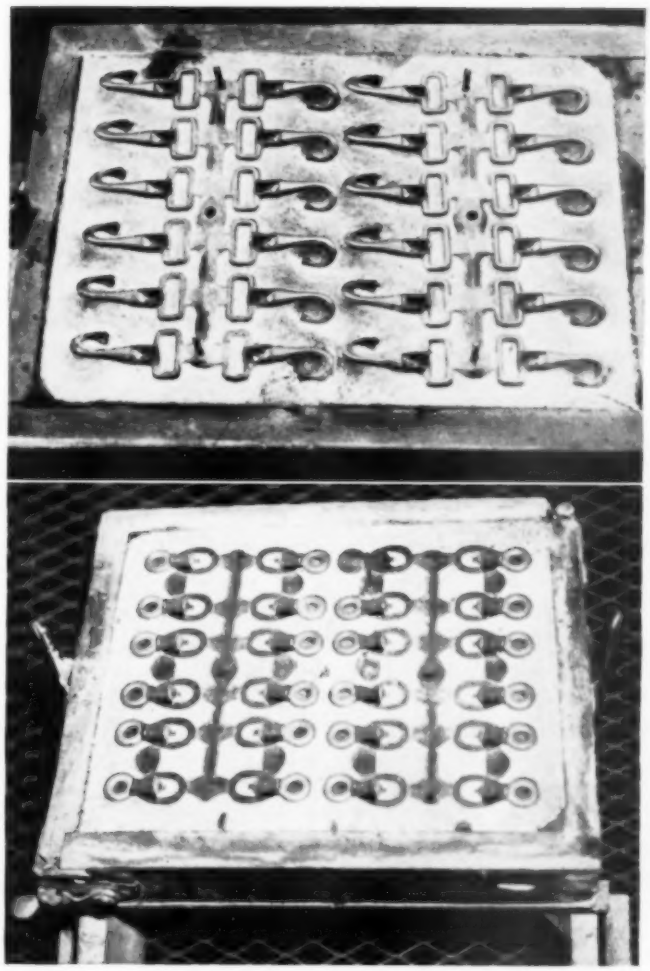
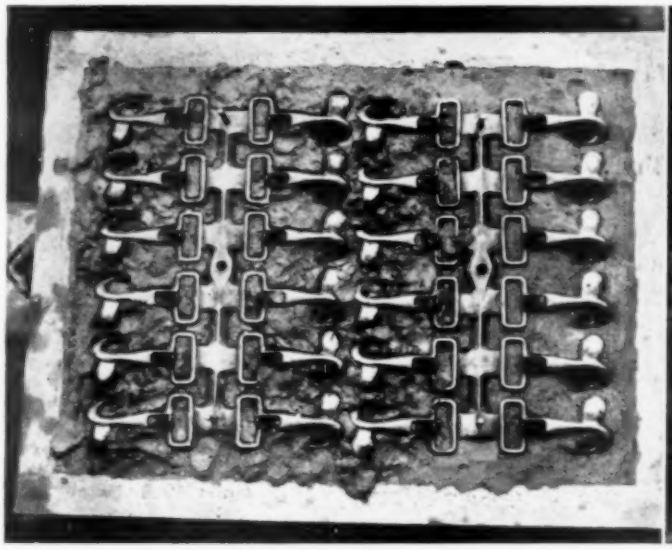


Fig. 6—(Above)—A group of patterns somewhat similar to those shown in Fig. 4, but finished ready for use. Fig. 7—(Below)—The part containing the swivel is cast first and then placed in the mold which forms the ring

The frame of the (*Please turn to page* 71)



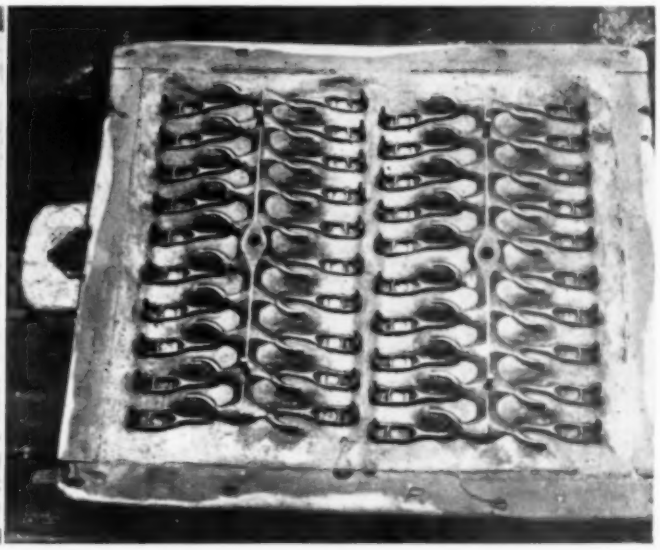


Fig. 4—(Left)—and Fig. 5—(Right)—Typical examples of the size and shape of the patterns usually mounted on the clay follow boards. Some work still remains to be done on the clay face of Fig. 4

Estimating Weights from Blue Prints

Method involves dividing casting into sections and applying standard formulas

By JOHN H. HILL
Glancy Malleable Corp.

SYSTEM is the first requisite for estimating the weights of castings from the blue print. The many computations must be carried out as accurately as possible and with a minimum of time and effort.

Analysis of the figuring of the small and comparatively simple casting shown in Figs. 1 and 2 indicates somthing like 50 separate computations and some three dozen conversions from fractions to decimals. This casting is not shown with the idea of demonstrating the solution of a difficult weight estimating job, but simply to illustrate the manner of attacking the problem.

Of course all the dimensions shown would not appear on the blue print. On occasion the weight estimator is forced to scale the drawing. However, he should do this only after scanning the list of changes—if any—made on the print. Then he can make allowance for parts thrown out of scale and also for shrinkage entailed in the blue printing process.

In some instances the only tool required is a pencil, but in the great majority of instances the following tools greatly facilitate the work: A triangle for drawing lines between views to help clarify the drawing, etc.; a protractor for determining degrees of angles not given on the print; a slide rule. This last item is most important for speedy and accurate work. Multiplication can be made in a fraction of the time required by any other method. The cost of these tools is merely nominal and skill in their use pays large dividends.

Formulas for figuring the cubical content of various shapes are shown in Fig. 2. A comprehensive list covering practically every conceivable shape was published serially in the Data Sheets of THE FOUNDRY several years ago. They now are available in the *Foundrymen's Handbook*. Simple application of a few of the formulas taken from Fig. 2, are as follows. For identification and reference the various parts of the casting under discussion have been lettered: *A*, *B*, *C*, *D*, D_1, *E*, F_1 and F_2. Briefly the casting may be described as a small pedestal in which the cap and base are connected by two webs intersecting each other at right angles and with a cored boss forming the center of one of the webs.

Section *A* is a block or slab $1\frac{1}{8}$ x $1\frac{3}{4}$ x 7/16-inches ($\frac{3}{8}$ plus 1/16-inch finish) Cubical content of this section therefore is: 1.75 × 1.125 × 0.4375 = 0.862 cubic inches.

Section *B* includes the two segments at the ends of *A*. The formula for the solution of such shapes, not including the thickness is *S-cb*. as shown in Fig. 2. According to a formula in Fig. 2, the area of the sector is R^2 *a* x 0.00873. In this instance $R = \frac{3}{4}''$ and *a* = 98 degrees, then by doubling the degrees to take care of both sectors, and including also the thickness, the formula becomes 0.75^2 × 196 degrees × 0.00873 × 0.4375 = 0.422. The product of *cb* × the thickness must be deducted from this total. Since *b* = half the width of section *A*, by

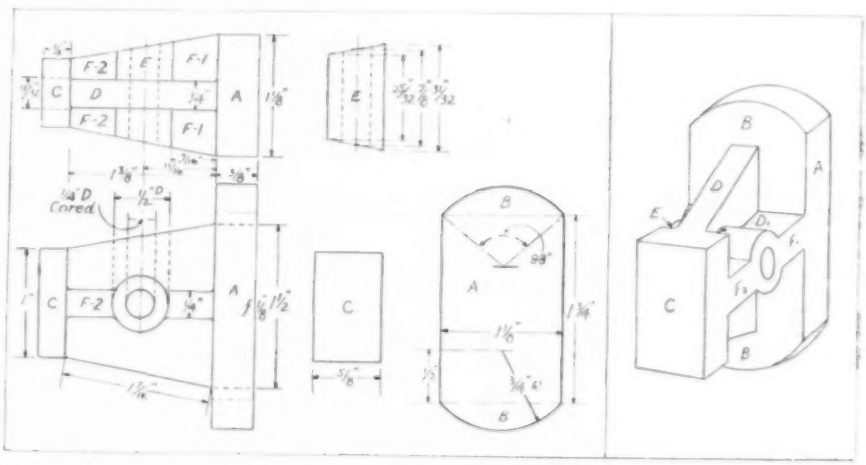
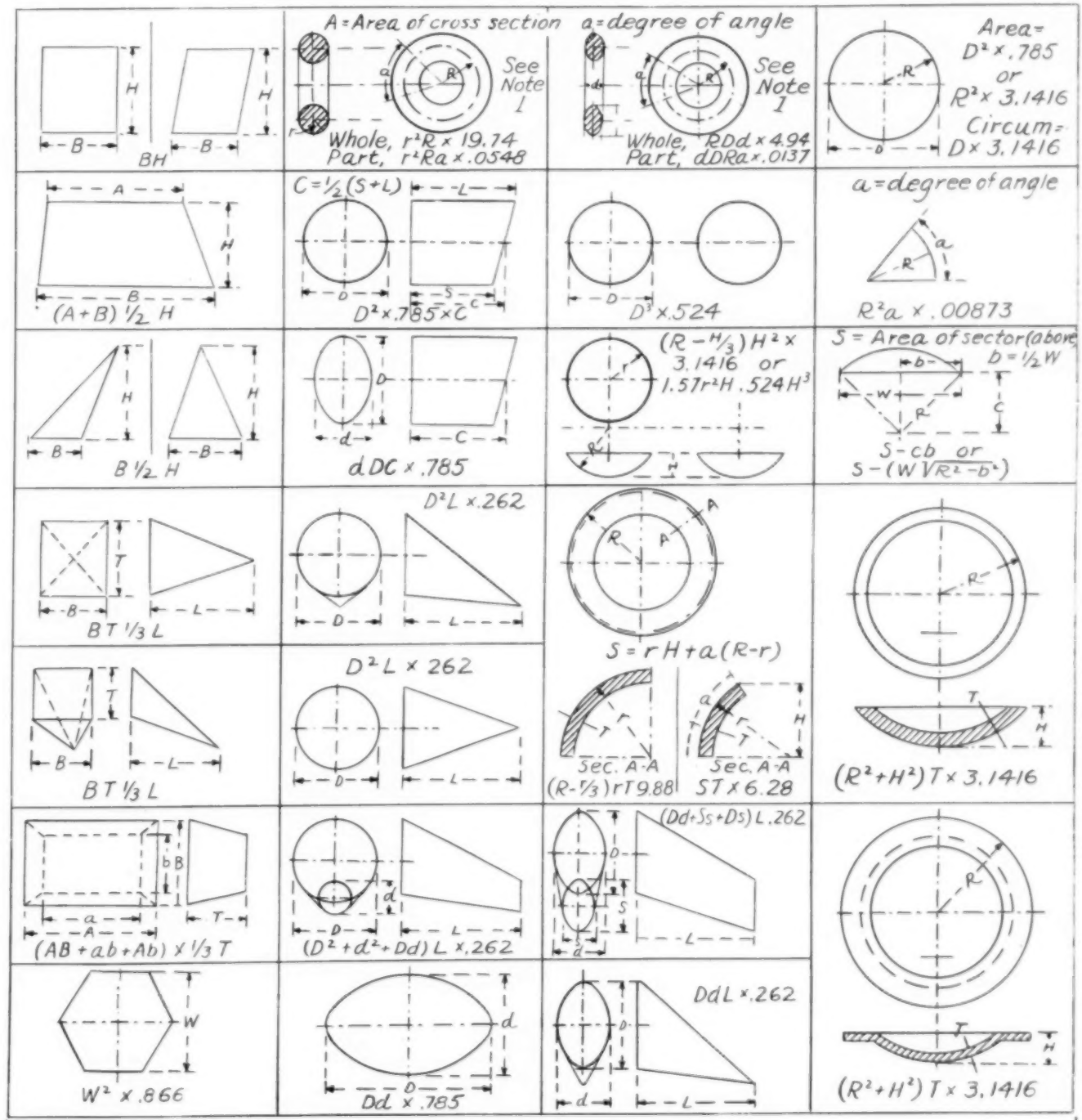


Fig. 1—Dimensions needed in the problem discussed in this article are shown on the drawing

doubling b both sections are included and therefore $b = 1\frac{1}{8}$ inches. The volume to be deducted then becomes $0.50 \times 1.125 \times 0.4375 = 0.246$ cubic inch.

Section C at the opposite end of the casting is somewhat similar to section A, but smaller in dimension, $\frac{5}{8}$ x 1-inch, $\frac{1}{4}$-inch thick. Expressed in decimals these figures become $1.00 \times 0.625 \times 0.25 = 0.156$ cubic inch.

Section D, one of the (*Please turn to page 72*)



Decimal Equivalents

	1—.0156	3—.0469	5—.0781	7—.1094	9—.1406	11—.1719	13—.2031	15—.2344
	17—.2656	19—.2969	21—.3281	23—.3594	25—.3906	27—.4219	29—.4531	31—.4844
64ths	33—.5156	35—.5469	37—.5781	39—.6094	41—.6406	43—.6719	45—.7031	47—.7344
	49—.7656	51—.7969	53—.8281	55—.8594	57—.8906	59—.9219	61—.9531	63—.9844
	1—.0313	3—.0938	5—.1563	7—.2188	9—.2813	11—.3438	13—.4063	15—.4688
32nds	17—.5313	19—.5938	21—.6563	23—.7188	25—.7813	27—.8438	29—.9063	31—.9688
16ths	1—.0625	3—.1875	5—.3125	7—.4375	9—.5625	11—.6875	13—.8125	15—.9375
8ths	1—.125	3—.375	5—.625	7—.875	4ths	1—.25	2—.5	3—.75

Note 1—Can be solved: Whole, A2R x 3.1416 Part, ARa x .00873.

Fig. 2—A variety of formulas which may be used in determining the weight of castings of various shapes. Decimal equivalents are given in the table at the bottom

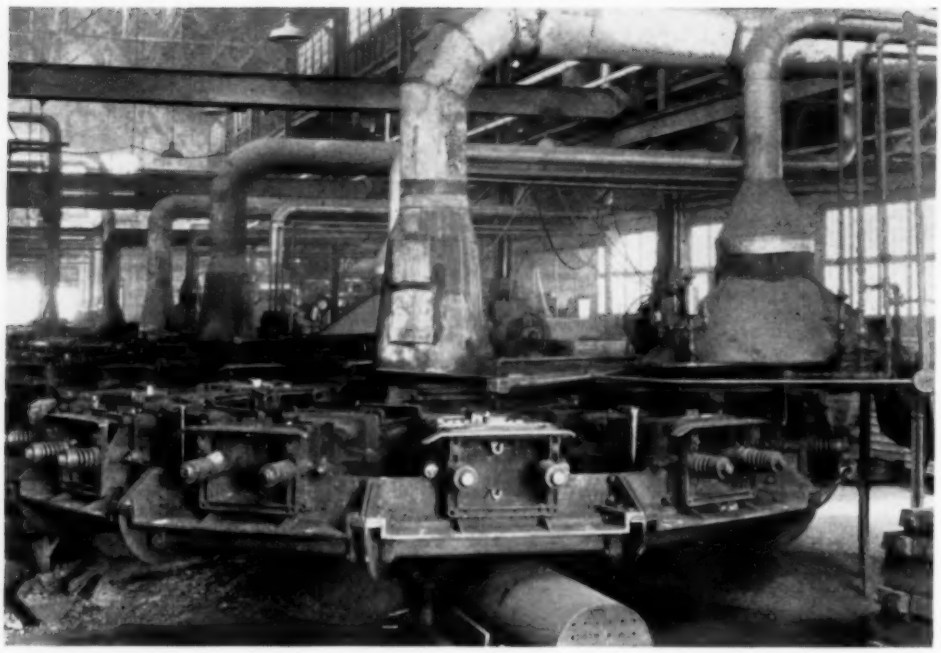


Fig. 1—A view of the row of automatic, rotary casting machines

Produces Castings in Metal Molds

Eaton-Erb Foundry Co. manufactures variety of gray iron castings on circular machines

By FRED ERB
and
EDWIN BREMER

APPLICATION of the permanent or metal mold process to a variety of different types of gray iron castings at the Eaton-Erb Foundry Co., Vassar, Mich., results from long experience in the technical and practical problems involved. After experimental work occupying several years, a type of mold was developed which has been employed successfully since, and involves the use of a large number of cooling pins about $\frac{3}{8}$-inch in diameter and 2 inches long all over the backs of the molds as shown in Fig. 5. The pins are spaced about 1-inch apart, and in operation a large volume of air is drawn across the pins which permits the temperature of the mold to be reduced to the proper operating point.

Each molding machine contains 12 molds, as shown in Fig. 1, arranged on the periphery of a wheel or table comprised of a similar number

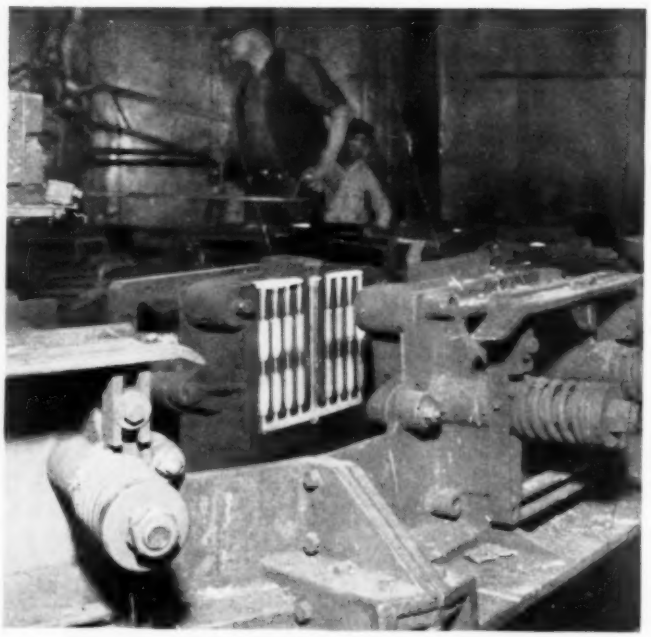


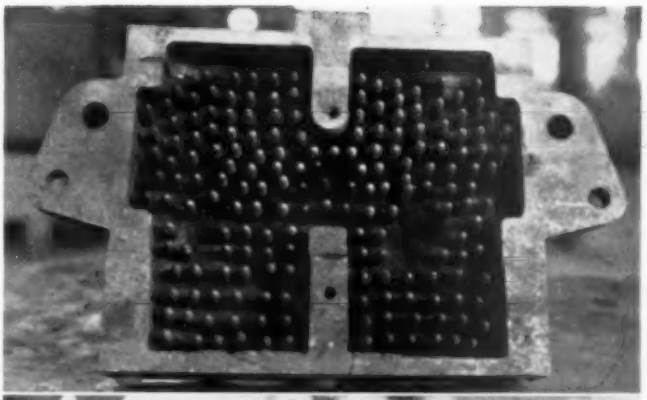
Fig. 2—Mold after opening with the white hot casting still in place

of cast segments bolted together. As may be observed, the table is about 2 feet above the floor level, and 14 feet in diameter. The table is supportd on a pedestal in the center which also contains the driving mechanism for rotating the table at any desired speed from one complete revolution in 1½ minutes to one revolution in 5 minutes.

The outer edge of the table is composed of 12 cast boxes about 12 inches long, 12 inches wide and 6 inches deep which are open at the top and have side openings. The side openings are bolted to hollow arm castings extending to the central supporting castings on the pedestal. The supporting casting which also is hollow is connected to an exhaust system which draws its air supply from the box castings mentioned, through the hollow arms.

One section of the permanent molds, which are made in two halves, is fastened permanently to the box so that the air passes over the pins on its back surface before entering the box. While the other half of the mold is moved forward and back from the stationary half by a pneumatic piston, it is also placed over the box so that air is drawn across its back when the two halves are closed.

Fig. 3—(Above)—Metal is transported from the cupola in bull ladles suspended from trolleys. Fig. 4—(Below)—Molds are smoked with an acetylene flame



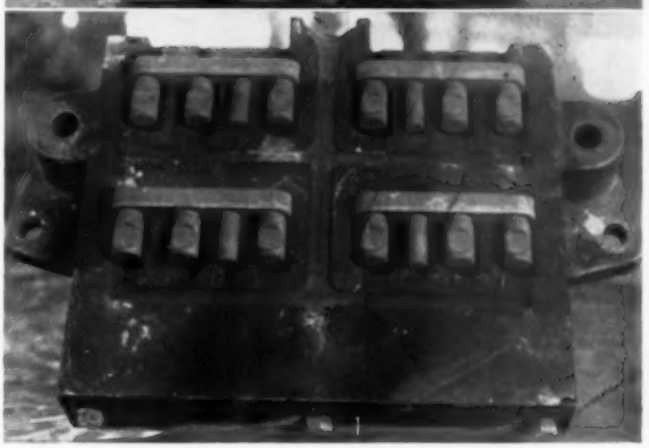


Fig. 5—(Above)—Back of molds are studded with cooling pins. Fig. 6—(Below)—Mold face showing method of gating and cores in place

Before the molds are placed on the machine for operation, they are heated to about 300 to 500 degrees Fahr., and the surfaces against which the molten metal is poured, are coated with a special refractory wash. The coating is applied extremely thin, and dries almost immediately on application. It is said that the refractory wash is essential and serves the purpose of preventing the metal from sticking to the mold surfaces and extendiag life of the mold materially by insulating it against direct contact with the molten metal. In addition to the refractory wash, the molds in operation are smoked with an acetylene flame adjusted to burn with little or no oxygen to obtain the maximum of soot or carbon. Refractory wash on the surfaces on which the metal does not directly impinge usually lasts a long time before it has to be renewed. However, on surfaces where the metal tends to eddy due to stream turbulence, the wash is applied one or more times a day depending upon the cutting action of the molten metal.

Acetylene gas for smoking the metal molds is generated in a separate building and piped throughout the found- (*Please turn to page* 74)

Profits Through Classified Costs

Accurate cost information must form basis for any intelligent merchandising program

By JOHN L. CARTER

PROFITABLE operation of a jobbing foundry depends on intelligent merchandising as well as efficient production. Both of these functions of management must be exercised efficiently to realize maximum profit-making possibilities. Merchandising is a much broader term than selling and may be defined as "the art of selling a product at a profit." It includes the determination of correct costs and selling prices; establishment of standards of quality which will enable selling on a quality basis rather than on a price basis; use of real salesmanship to get fair prices as well as volume; market analysis to determine what classes of work are likely to prove most profitable to the particular shop and market; and profit analysis to determine what jobs, accounts, and departments are producing the greatest profit, to permit pushing the most profitable lines, and replacing losing work with that which will produce its fair share of profit.

Costs a Factor in Selling

Many foundries producing at low cost, are not getting the full benefit of productive efficiency because they have not given suffiicient attention to merchandising. Although they are producing at lower-than-average cost, they are not making higher-than-average profits, because they are getting lower-than-average prices, and are losing on some accounts and departments, without realizing it, most of the profits which they earn on other lines. With a little more attention to cost accounting and merchandising, these foundries should increase the proportion of profitable work in their shops, and by using more real salesmanship, should get at least as high prices as anyone else. Their productive efficiency then would show up in actual increased profits.

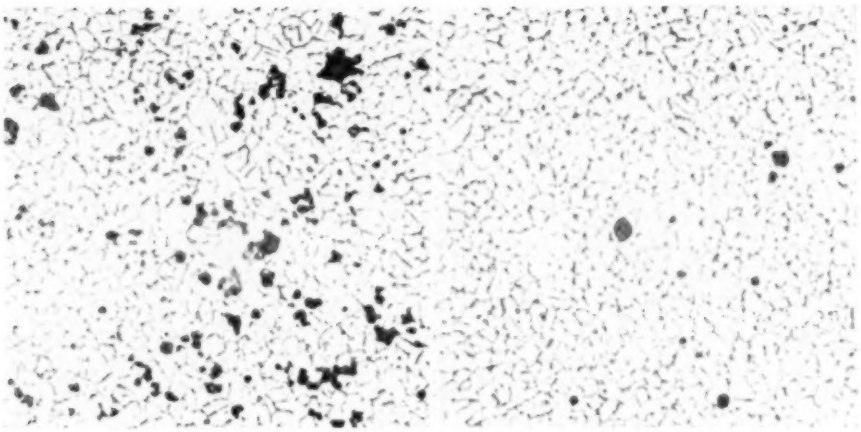
The first requirement for intelligent merchandising is accurate cost information. Without accurate cost information, the foundryman will waste a lot of time on work which other foundries would not take at his price, or which is overcompetitive, or which he thinks is profitable but actually shows a loss. An incorrect cost system, like a poor road map, is worse than none, for it gives the foundryman a false feeling of confidence that he is on the right road to profit, when actually he is on the wrong one. Since the gray iron industry has a reliable and accurate *Standard Cost System*, there is no excuse for the foundryman continuing to rely on incorrect and misleading methods of figuring cost.

Fallacy in Flat Molding Overheat

One of the most serious errors in figuring cost is the use of one flat molding overhead percentage for all jobs. This is absolutely incorrect and misleading. Overhead on heavy floor work under the crane is much higher than overhead on bench work, and overhead on jolt work usually is still higher. Each molding department—heavy floor, light floor, squeezer, bench, and jolt—requires a different amount of labor and expense per dollar of direct labor, and these differences are considerable. Actual figures from a great many different foundries show that overheads in various molding departments usually vary between the following limits (these overheads do not include cleaning cost, which sometimes incorrectly is included in molding overhead):

	Per Cent
Jolt roll over	150 to 250
Heavy floor	110 to 160
Light floor	100 to 130
Squeezer	90 to 120
Bench jobbing	70 to 100

Reasons for these variations are obvious to any one familiar with a foundry. Overhead percentage will be increased either by higher indirect expense or lower direct labor cost. The bench department naturally carries the lowest overhead, for direct labor is high, and it requires the least floor space, the least equipment, and the least indirect labor. Molders usually shake out their own molds and cut their own sand, whereas in the squeezer department this work often is done by laborers. In the squeezer department, direct labor (*Please turn to page* 78)



Figs. 1 and 2—Showing grain structure of extruded yellow brass rods, X100, excessive lead content at left, normal lead content at right

Prevent Segregation in Bronze

Pouring temperature plays important part in checking migratory tendency

By JAMES BRINN

DOWNWARD migration of the heavier constituent is a common type of heterogenity in nonferrous alloys. Thorough stirring is necessary to prevent segregation. Since lead has the highest specific gravity of the common metals, alloys high in lead are particularly subject to segregation and may result in considerable variation in chemical composition. The following may be regarded as a typical example: Borings taken from the top of a solder pig, average composition 50 per cent tin and 50 per cent lead showed a content of 59 per cent tin; while borings taken from the bottom of the same pig showed only 45 per cent tin.

Ordinary red brasses and brones typified by the 85 per cent copper, 5 per cent tin, 5 per cent lead and 5 per cent zinc alloy show little or no tendency toward lead segregation. If segregation takes place it is so slight that it exerts no perceptible influence on the soundness of the casting or on the properties of the alloy.

However, one exception must be noted: Art bronze castings containing copper 92 per cent, tin 6 per cent, and zinc 2 per cent treated chemically for coloring, should not contain any lead, or, at the most 0.25 per cent of this element. The slight segregation which takes place if more lead is present is not visible after polishing and buffing, but the coloring shows the surface to be spotty and thus indicates the segregation.

Art bronze containing lead which shows no segregation after coloring may be obtained, but this metal requires a thorough stirring in the pot before it is poured. Thorough stirring takes time and therefore may result in castings poured too cold. The remedy, of course, would be to heat the metal to a higher temperature in the furnace. To do this and then do all the stirring just to incorporate a small quantity of lead in the alloy naturally is not a practical proposition.

Effect of Lead Was Known

Effect of lead on art bronzes was known to foundrymen as far back as the eleventh century. They distinguished between bronze containing lead for undecorated castings and bronze containing no lead for castings to be gilded. Electricity and electroplating were unknown in those days. The gilding process was chemical

Ordinary red brasses show little or practically no tendency toward lead segregation, but this is true only where no aluminum or silicon are present. Presence of even a small percentage of aluminum or silicon causes increase in grain size, a porous, weak structure and *lead sweat*. Nickel in considerable amount reduces the bad effect of aluminum and silicon. In a nickel silver alloy containing 58 per cent copper, 18 per cent nickel, 5 per cent lead and the remainder zinc, alumi-

num up to one half of one per cent will not cause lead sweats.

Aluminum is added to this alloy on account of the ability of aluminum oxide to form a thin, tenacious film over the molten metal. This film suppresses the zinc oxide fumes, which otherwise would pollute the atmosphere and render conditions uncomfortable in the foundry.

As a rule, castings made from 80 per cent copper, 10 per cent tin and 10 per cent lead bearing bronze are free from segregation if the metal is stirred properly before pouring and if the alloy is free from detrimental impurities. Overheating the metal results in slow solidification and this in turn causes segregation of the lead, porosity and weak grain structure.

High Lead Content a Problem

The zinc content of the alloy should not exceed 1.00 per cent. Sometimes cheaper alloys containing up to 3.00 per cent zinc are substituted and if these are not properly compounded trouble may occur due to lead segregation. In one instance, castings containing 78.72 per cent copper, 7.56 per cent tin, 10.84 per cent lead and 2.88 per cent zinc were badly segregated while similar castings containing 82.50 per cent copper, 8.28 per cent tin, 7.55 per cent lead and 1.67 per cent zinc were perfect and showed no sign of lead sweat. Tendency toward segregation is more and more pronounced with increasing lead content. To make perfect castings with lead content of 25 per cent or higher sometimes becomes quite a problem.

Years ago customers for locomotive brass packing rings specified an alloy containing 50 per cent copper and 50 per cent lead. As a matter of fact it is impossible to make a proper alloy of this composition. The metals separate in two layers, one rich in copper and the other rich in lead. Even thorough stirring does not prevent this separation. Where nickel is added in increasing amounts the segregation becomes less and less pronounced. With a nickel content of 7 per cent the segregation practically disappears. Sulphur is considerably more effective in preventing segregation. From 0.75 up to 1.00 per cent is sufficient. Sulphur is added either in stick form or as galena, an ore, carrying both lead and sulphur.

The 50 per cent copper, 50 per cent lead alloy to a great extent has been replaced by the so-called plastic bronzes containing up to 30 per cent lead. They are used for bearings where lubrication is maintained under difficulties. A typical plastic bronze contains 70 per cent copper, 5 per cent tin and 25 per cent lead. Where difficulty is experienced making castings of this alloy free from lead segregation, several elements are recommended.

Sulphur will keep the lead in uniform distribution, but this alloy is more sensitive to sulphur addition than the 50 per cent copper 50 per cent lead alloy. An excess of sulphur causes the metal to rise and foam in the mold and to develop a large number of small pin holes which appear when the casting is machined. The sulphur should be introduced, not as stick sulphur or galena, but as plaster of paris. An excess of this flux is harmless.

Maintains Uniform Distribution

Nickel also is employed for the same purpose. One per cent of this metal usually is added, although greater percentages would be still more effective in keeping the lead uniformly distributed. According to a German source (*Giesserei Zeitung*, 1929, p. 99) sodium in amounts of about 1 per cent, also prevents lead segregated. To reduce the hazard of introducing sodium, it should be added either as a sodium lead or a sodium tin alloy. *Mining and Metallurgy*, Jan. 1930, contains a reference to investigations made by two large research laboratories in this country on the use of metallic barium in preventing segregation in plastic bronze.

Phosphorus generally used as a deoxidizer for bronze has the property of retarding the lead segregation in plastic bronze. From 2 to 4 ounces of 15 per cent phosphorus copper to every 100 pounds metal may be considered a proper amount. (*Please turn to page* 81)

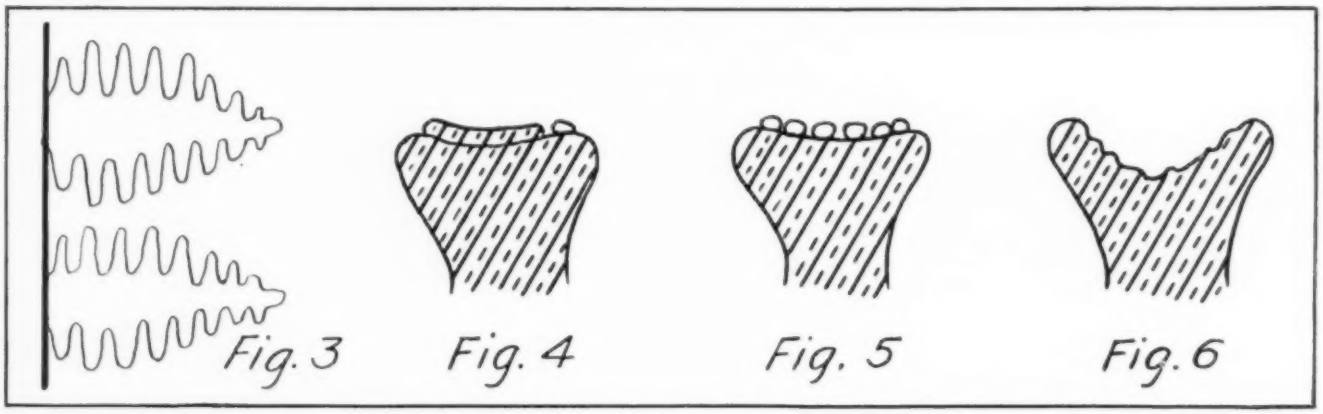


Fig. 3—Typical example of dendritic structure. Fig. 4—Example of exuded metal poured at high temperature. Fig. 5—Exuded metal on riser in which the metal was poured at lower temperature, but still too hot. Fig. 6—This riser shows normal shrinkage with no exuded metal, result of pouring the metal into the mold at the proper temperature

Effect of Chromium on Cast Iron

Study of three separate types of iron shows influence of alloy on properties

By CHARLES O. BURGESS
Union Carbide & Carbon Research Laboratories

IMPROVEMENT in quality of cast iron by alloy additions has been a metallurgical accomplishment of recent years. Work in this field has shown that chromium is one of the most effective of such additions, but in general, the influence of chromium has been studied only in connection with other alloying additions, with irons other than foundry irons, or with relatively high percentages of chromium. The present study was initiated to determine the influence of small additions of chromium (0.25 to 1.00 per cent) on the quality and resultant properties of cast irons of various foundry grades.

Three separate types of cast iron were investigated. The first series was prepared from remelted foundry cast iron at the Union Carbide & Carbon Research Laboratories, and the other two series consisted of cupola melts made under usual operating conditions.

The first series was made by melting 30-pound charges of foundry scrap iron containing 2.86 per cent carbon, 2.72 per cent silicon, 0.50 per cent manganese, 0.062 per cent sulphur and 0.794 per cent phosphorus in a carbon resistance furnace. Chromium was added as high-carbon ferrochrome just before pouring. Irons were cast at approximately 2282 degrees Fahr. The analysis and physical properties of these irons are given in the accompanying table, test 1. The second set was made in a cupola in accordance with normal practice, the charge containing approximately 42 per cent steel scrap and the chromium additions being made to the ladle. Analysis and tests of these heats are shown in the accompanying table, test 2. A small amount of copper was present in heat C of this series.

Further data on the effect of chromium on strength was obtained from a third series of 13 cupola heats containing from 0.06 to 0.50 per cent chromium and made without steel additions. The heats were all within the analysis limits 3.60 to 3.92 per cent carbon, 2.00 to 2.50 per cent silicon, 0.50 to 0.63 per cent manganese, 0.042 to 0.080 per cent sulphur, and 0.300 to 0.485 per cent phosphorus. Ladle additions of chromium were made in the form of high-carbon ferrochrome.

May Pour Metal Hotter

Recovery of chromium from ladle additions was found to be approximately 90 per cent in these tests. While ladle additions of chromium were made throughout the series, an alternate method of addition is available—that of adding briquetted chromium to the cupola charge.

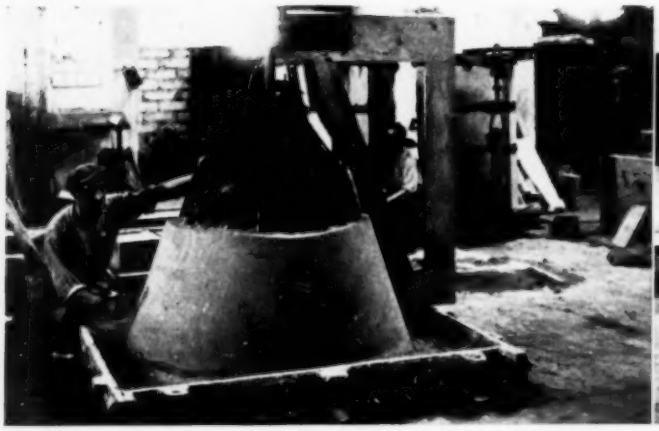
To determine influence of chromium on fluidity, cupola cast irons containing various amounts of chromium up to 0.9 per cent were used to cast transverse bars, fittings, 2-inch elbows and plates. No appreciable difference in the fluidity of irons was noted in these sections. However, other work has shown that in pouring castings having very restricted or thin sections it may be advisable, as with pearlitic iron, to pour the metal hotter than in the case of ordinary gray iron.

A number of (*Please turn to page* 82)

Physical Properties of Cast Irons

No. of Sample	Composition, Per Cent: Total C	Comb. C	Si	Mn	Cr	P	S	Physical Properties of 1¼-in. Bar, 12-in. Centers: Transverse Strength, Lb.	Deflection, In.	Tensile Strength, Lb. per Sq. In.	Brinell Hardness
					TEST 1						
1-A	2.80	0.33	2.28	0.50	0.03	0.678	0.081	2,300*	0.12	25,200	152
2-A	2.78	0.41	2.42	0.50	0.26			2,900	0.15	29,600	176
3-A	2.83	0.63	2.80	0.50	0.37			2,800	0.14	30,600	185
4-A	2.93	0.83	2.22	0.50	0.52			2,800	0.11	29,200	192
					TEST 2						
A	2.80	0.46	2.53	0.77	0.01	0.240	0.092	3,500**	0.103	36,270**	200
B	2.85	0.52	2.52	0.70	0.48			4,035	0.112	42,550	212
C	2.98	0.57	2.57	0.80	0.79			3,750	0.103	41,650	217

*Average of two tests. **Average of three tests.



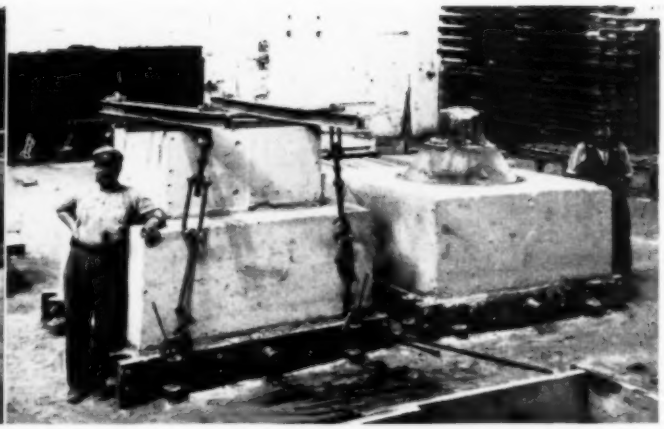


Fig. 1 (Left)—Loam molding a core for a cast iron vat. Fig. 2 (Right)—Molds for vats. The mold at the left is ready for pouring

Bonds Sand Molds with Cement

New method of molding is practiced by French foundry producing steel castings

By VINCENT DELPORT

AN INTERESTING process for making molds in which to pour molten metal in the manufacture of castings, and which has as its principle the use of a mixture of sand and cement as molding materials, has been developed by the Compagnie Randupson, Marseille, and the Societe d'Electro-Chimie, d'Electro-Metallurgie et des Acireies Electriques d'Ugine, Savoie, France. The sand used is a pure siliceous material and a high grade of Portland cement is mixed with the sand in the proportion of 15 parts in weight of cement to 100 parts of sand. Cement of the quality used in the process begins to soften only at temperatures above 2732 degrees Fahr., and the melting point is over 2912 degrees Fahr.

Sand mixed with the cement must be such as not to retard setting and hardening of the mixture during drying, and sand with clay must not be used. On the other hand, the siliceous sand may be replaced by such materials as pulverized coke, quartzite, powdered refractory bricks. Broken-up molds made with the mixture can be used again. The mixture of sand and cement, which must be moistened correctly, hardens when it sets. A pattern can be imprinted easily during the plastic state, and a mold is produced which, when set, is rigid and resistant.

Amount of moisture given to and retained by the mixture is a question of considerable importance, as it affects the plasticity of the mix-

Fig. 3—Closing a mold for a water wheel

ture and permeability of the finished molds. At the Ugine steel foundry the sand and the cement are of known composition and mixed in definite proportions. The exact amount of moisture which gives best results is known, and the amount of water, which is sprinkled during the mixing process, is fixed in accordance with these known factors. It has been found that the percentage of water with reference to the cement, in volume, should be between 70 and 90 per cent to give the best results.

Measure the Permeability

Permeability of the molds is measured rapidly by a simple apparatus. A brass cylinder, fitted at the extremity with a rubber cup, is connected by rubber tubing to a bottle containing air at a minimum pressure of 50 kilograms per square centimeter (711 pounds per square inch). Air is admitted to the brass cylinder by a release valve. The rubber cup end of the cylinder is applied against the mold, and a low-pressure manometer fitted at the top part of the cylinder shows the pressure in the cylinder, which has been reduced by the air that passes through the mold. To adjust this instrument, the rubber cup is applied against a well-planed metal plate, in which case the permeability is nil. The main valve of the bottle then is opened, and the release valve is opened until the manometer shows a pressure in the cup of 1.750 kilograms (24.89 pounds per square inch). This operation is repeated several times until two or three successive operations give the reading of 1.750. The greater the permeability of a mold, the lower is the reading on the manometer. For ordinary molds for cast-iron and steel practice, the readings should not exceed 500 grams per square centimeter (7 pounds per square inch).

The strength of the sand-cement mixture, when set, is practically independent of the ramming of the sand during molding operations, and is ample to sustain the efforts due to ferrostatic pressures. To overcome tension stresses of the molds, iron rods are inserted.

Molds can be made in any of the usual ways, by hand or with a machine. A stripping machine, preferably of the rollover type, is recommended, however, to avoid retouching of the mold. After having been stripped, molds are left to set and dry in the atmosphere of the foundry. Setting takes place during a period ranging from 24 to 48 hours, when the molds are ready for pouring. The period of setting depends, of course, upon the size of the molds, the cement used, and the degree of moisture of the atmosphere. (*Please turn to page* 85)

Fig. 4 (Upper Right)—Placing cores and closing mold for turbine wheel. Fig. 5 (Center)—Mold for turbine wheel in a more advanced state. Fig. 6 (Lower Right)—Completed mold ready for pouring

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the following advisory staff: Steel, John Howe Hall; Malleable, H. A. Schwartz; Gray Iron, John W. Bolton; Nonferrous, N. K. B. Patch

Height of Cupola Tuyeres Depends on the Iron Required

What is the correct volume and pressure of blast, also the correct height from the cupola bottom to the center line of the tuyeres in a cupola with a 36-inch shell lined to 27 inches.

Off hand an approximately correct answer to your inquiry would be: Pressure of blast 8 ounces; 1150 cubic feet of air per minute; 10 inches from sand bottom to *bottom* line of tuyeres. However, each one of these items may be changed to a considerable extent to meet local conditions. For example a large blower capable of delivering the required volume of air at 4 or 5 ounces pressure would answer your purpose. The volume and not the pressure is the important factor. The only reason for specifying 8 ounces pressure is that a pressure of that intensity is required with the small blower usually attached to a 27-inch cupola.

The item of 1150 cubic feet of air per minute is based on the assumption that the cupola is operated practically at capacity, that is at a melting speed of 5700 pounds per hour. This involves careful charging, iron broken into small pieces and coke with a carbon content of at least 80 per cent. A change in any of these factors will affect the absorption of the blast to the full extent. Measurements in a cupola are taken from the bottom of the tuyeres and also from the top of the tuyeres instead of from the center line. Tuyeres vary to such an extent, according to the whim of the designer, that a center line measurement would convey no information, excepting of course where the actual size of the opening in the tuyere is also given. The bottom line of the tuyere decides the amount of metal that may be held in the well of the cupola before it is tapped. The top line of the tuyeres is the base for measuring the height of the coke bed.

A 27-inch cupola with a 10-inch well between the sand bottom and the bottom line of the tuyeres will hold approximately 1000 pounds of molten iron between taps. That amount is considerably in excess of the amount usually required at a single tap in a foundry served by a 27-inch cupola. Where a slag hole is employed, the amount of metal that can be accumulated in the well of the cupola is limited by the height of the slag hole and not by the height of the tuyeres. In an emergency the slag hole may be closed temporarily to gain a couple of inches of metal, but good practice favors an open slag hole throughout the heat.

Reclaiming Used Sand Reduces Costs in Steel Shop

We use practically all new sand for facing in our steel foundry. With 100-ton production per month we are wondering if it would pay to install a complete sand handling and reclaiming outfit, as shakeout table, elevators, belt conveyors, measuring hopper, breaker screens, magnetic separators, or, would an ordinary vibrating screen served by an elevator serve our purpose.

All new sand is necessary in the facing on many castings, but usually the majority of castings made in any steel foundry may be faced satisfactorily with sand containing varying amounts of new sand up to 50 per cent. A mixture based on all old sand and properly prepared will produce a satisfactory skin on a wide variety of small and medium weight castings. At this distance and without a personal knowledge of all the factors involved we are in no position to profer specific advice. For example the problems of a foundry producing a uniform line of castings, are radically different from a foundry producing a widely diversified line of large and small castings and also differing in chemical composition and physical properties.

The broad general statement may be made that mechanical equipment insures a uniform

quality of sand to any desired specification. Adequate blending of the sand effects substantial reduction in the amount of new sand required. Manufacturers of sand handling equipment have had long experience and we should be inclined to accept their statements and claims. By comparing your present costs with the estimates submitted by the sand handling equipment manufacturer, you can deduct the cost of maintenance, deterioration, and amount of capital involved, and thus arrive at a close approximation of the saving to be effected over a definite period. Usually the amount is sufficiently attractive to warrant the installation.

Holes in Iron Casting May Have Variety of Causes

We are sending a small hatchet made of gray iron which has numerous pinholes at the lower part where it has been ground. It is causing us considerable loss, and trouble with our customers. The furnace company which we obtain our iron believes our sand is too wet, but our sand is not any different than it has been for years. Our cupola practice is the same also, and we have in mind that the trouble is due to higher sulphur in the coke, or something wrong with the iron.

Examination of the hatchet reveals a well founded reason for complaint. Not only on the portions that are ground, but all over. One peculiarity if it may be thus termed, is the fact that the holes have bright interiors which in our estimation precludes stating that the cause is due to wet sand. Trouble of that nature leaves holes with an oxidized or dull interior. Moreover, the pinholes are not joined together, but are distinctly separated, and are located both on the cope and drag side, as well as along the other two faces of the mold.

Our opinion is that the pinholes result from what usually is called burnt iron. However, it is difficult to state a correction for the trouble as it may be caused by any of several things. The first suggestion is to check your cupola practice and see that you are not using an excess of air, or using it at too high a pressure. The next consideration is the scrap and pig iron used in the mixture. If you are using extremely rusty scrap, or that containing any burnt grate bars or similar material, it should be eliminated as it is a prolific source of trouble. Then comes the pig iron.

The only way to determine the cause of the trouble when you are sure your cupola practice is correct, is cut and try. First leave out all the scrap you are using, and note the effect. If the holes are eliminated you need look no further. However, if the holes still are evident, it may be the pig iron. If you have several cars on hand, try using one at a time until you find out the trouble maker, and then only use a small amount of it in the mix. A temporary relief might be obtained by dosing the iron in the ladle with a small amount of commercially pure aluminum (not an alloy).

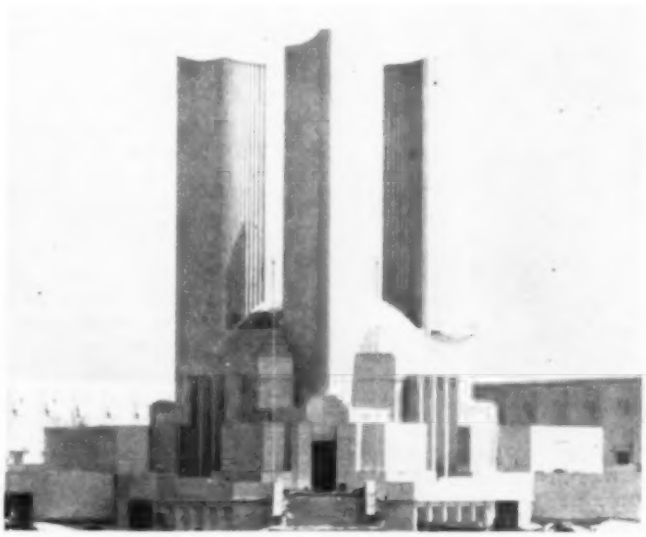
Mold Conditions Cause High Loss in Brass Castings

Under separate cover I am forwarding pieces of defective brass casting, also a blueprint showing details of the finished part and the methods adopted for gating. The mold is made in a good grade open sand and the core is an oil sand mixture. The metal is secondary brass ingot 85-5-5-5 melted in a crucible coke fired pit furnace. It is melted at a temperature of 2300 degrees Fahr. and poured at 2100 degrees. We have exercised the greatest care in melting the metal and have tried gating the mold at the top and the bottom, but our scrap loss is excessive. The castings under the skin are filled with small holes. We shall appreciate your opinion on how to produce these castings satisfactorily.

The method of gating these castings is not a factor of importance. Any style of gate that will admit the metal readily may be employed. The defective castings are caused by the condition of the mold or core, or both. Rectify these conditions and you will have no further trouble. Due to any one of many possible causes, the metal does not lie quietly. Either steam from the sand on the outside or gas from the core on the inside, causes the metal to *boil*.

The walls of the casting are so thin that the metal sets before some of the bubbles escape. They are trapped in place and form the cavities which later are disclosed when the casting is machined. Sand for these molds should be worked as dry as possible. A row of vertical vent holes around each mold will facilitate the escape of steam. Unless with very open sand, this precaution is essential where two or four castings are molded in a single flask.

The core is the most probable cause of your trouble and is the first factor to be examined in your process of elimination. The least flutter in these thin walled molds will show up later as



Fluted towers on the Federal building, the Chicago Century of Progress, represent the executive, legislative and judicial branches of the government

cavities in the casting. Therefore a core must be used which will allow the metal to lie against it *dead*. Reduce the bond in the core mixture to the absolute minimum. Place a large vent hole in the center of the core—2 inches diameter is not excessive—and dry the core almost to the point of burning.

Holes in Castings Caused by Slow Melting

We make brass bushing castings for the oil field trade from 1 to 8 inches in diameter, 12 inches long, with cores of various sizes from $\frac{5}{8}$-inch in the smaller sizes to 4 inches in the larger ones. The castings often show numerous small holes throughout when machined, and they have spots that indicate the metal is spongy. We use yard scrap such as old bushings, and other similar scrap, and among other things a lot of pump liners that have been removed from pumps. With this miscellaneous scrap we use 25 per cent copper wire cut up to small sizes and put in the crucible first and when melted, add the scrap. We use a proprietary brass cleanser liberally and have the metal quite hot before taking from furnace. We use coke in our furnace and melt a No. 45 crucible full in about 3 hours the first heat and about 2 hours afterwards.

It is apparent that your problem is that of gas absorption during melting. Having a No. 45 crucible of metal in the furnace even 2 hours is excessive, to say nothing of 3 hours.

It will be well to examine your flues, grates and chimney to be sure that there is no obstruction to a free flow of air through the furnace. A properly built coke furnace, which has an ample supply of air for combustion purposes, should enable you to melt this quantity of metal in not to exceed 1½ hours. Slow melting is disastrous to the production of sound castings, since the soaking of metal in the furnace is obviously the source of dissolved gases, which when the metal solidifies are thrown out of the solution forming these small holes described by you as being prevalent in the castings.

It sometimes is possible to compensate for this trouble by pouring the metal cold and gating the castings so that such cold pouring is feasible. This, however, is simply a doubtful expedient to try to compensate for a mistake that should be cured. It might be possible for you to improve the quality of your castings materially, if you were to melt your scrap, borings and scrap copper in larger crucibles and pouring this metal off into ingots, after which you would charge your small crucibles with the ingots and melt them very rapidly, pouring your castings from these small rapidly melted heats and thus insure a minimum gas absorption and therefore maximum soundness.

Trace Blowholes To Numerous Causes

We are forwarding for your inspection two specimens of defective parts from our cast iron boilers. You will note several small cavities in each, not confined to any one locality but appearing promiscously. In nearly all cases where this condition has been found, the castings were poured in the first part of the heat. In our opinion, occluded gas—if there is such a thing—is present in the molten metal and does not escape before the metal solidifies. We shall appreciate your opinion on this point, or, do you think the cavities are caused by steam from a wet ladle lining, dissolved oxides or oxidized iron.

Any one of the causes you mention would produce the results shown in the fragments of castings which accompanied your inquiry. Another possible cause is the composition of the iron in the charge. Many prominent men hold widely divergent theories on this particular point, but all agree that batches of pig iron occasionally produce characteristics which a foundryman would not anticipate from the analysis. With so many possible causes for the small scattered blowholes, it is apparent that the only way to find the real cause in the present instance, is a process of elimination, by which each cause is given a thorough examination and then either accepted or rejected.

Since this form of defect appears only in the castings from the first part of the heat, and assuming that the iron charges are of uniform composition throughout the heat, suspicion naturally falls upon wet ladies or a wet bottom in the cupola. If the defects continue after the proper remedies have been applied to the ladles and the sand bottom of the cupola, attention might be given the moisture content of the sand in the molds. Excessive moisture, or excessive bonding material in the sand will set up a commotion in the iron sufficient to produce the defects shown in the samples submitted with your letter.

If the sand presents a satisfactory alibi, you might check up on the blast pressure and volume of air entering the cupola. At the beginning of a heat and also near the close, a heavy blast produces a bessemerizing effect on the molten iron, which means that some of the iron is burned or oxidized and the silicon and manganese content reduced to a considerably greater extent than under ordinary conditions. The burned iron holds gas in a manner that may be compared to a sponge, and this condition is accentuated by the loss of silicon which reduces the fluidity. Most of the gas escapes, but a sufficient amount is trapped before the metal solidifies to present the cavities shown in your samples. The obvious remedy of course in a case of that kind is to reduce the blast pressure for one or two heats and note the effect on the first castings poured from each heat.

Discard the Sand Where Cinders Are Used

We are operating a steel foundry in England, and it is our practice to lighten out our cores with ashes and cinders such as can be obtained from the bottom of gas producers. We are interested in sand reclamation, and have a number of papers on the subject, but we cannot find any reference to the presence of ashes and cinders in the sand. If the ashes and cinders are not removed from the sand, there will be a gradual reduction in the melting point of the sand, and we would like to know whether the various types of sand reclaiming and cleaning machines on the market are capable of removing the fine ash from the cores which, of course, must get into the sand.

The practice of adding ashes or rather cinders to lighten out cores is common practice in general jobbing shops where cores of considerable size and perhaps intricacy are employed. Foundries in this country employing that practice are in the habit of discarding all material knocked out of the casting in the roughing-out operation, rather than leaving such material to go into the general body of sand with the ultimate uncertainty of its effect on the castings of the future. There is no doubt that, assuming the sand to be dry when it reaches the average type of reclamation apparatus, either of the screen type or of the combination pneumatic and screen type, any fine ash would be removed without difficulty from the sand.

As a matter of fact, it is rarely the case that fine ash is used for these purposes—rather it would be in the form of graded cinder. Such cinder would be carried forward in the sand, and would constitute a trouble if portions of the sand were used in the making up of facing sand mixtures, which is a regular procedure. Consequently, it is safer to use cinders where necessary, but discard all the material which can be removed from the casting, internally and externally, immediately after shaking out. That, of course, will eliminate any trouble from the cinders.

Viewing Foundry Developments

At Short Range

MANY of the hazards inherently involved in the production of a twin-six automobile engine cylinder block have been removed by assembling all the cores in an accurate jig provided for the purpose. Here they are fitted, gaged, examined and inspected, before they are lifted as a unit and lowered into the green sand mold. Guide pins on the jig and corresponding pin holes in the joint flange of the flask insure accurate placing of the cores in the mold. Metal is poured from two ladles on opposite sides of the flask and enters the mold near the bottom.

♦ ♦ ♦

It is claimed that a new high temperature refractory has been developed in Germany that has a fusion point above 3632 degrees Fahr. and that with a load of 28 pounds per square inch no reduction of compressive strength was observed at 3290 degrees Fahr. Tests on change of volume without load show that only between 1652 and 1832 degrees Fahr. are special precautions necessary. The refractory is composed of 20 to 40 per cent chromium oxide; 18 to 30 per cent magnesia; 25 to 40 per cent alumina, and 8 to 14 per cent other elements. It is said that its use in openhearth furnaces increases the life of the furnace and reduces construction costs.

♦ ♦ ♦

MALLEABLE foundrymen have considered chromium as a source of trouble, but today up to 0.50 per cent is being used commercially in the manufacture of that class of castings. The effect of chromium in preventing the annealing operation is overcome by increasing silicon. A number of test bars containing 0.30 per cent chromium with 1.40 per cent silicon averaged about 80,000 pounds per square inch tensile strength with over 9 per cent elongation.

♦ ♦ ♦

Preheating the cupola blast accelerates combustion in the region of the tuyere zone. It results in faster combination of the oxygen in the blast with carbon or the coke. In this way, it results in a higher temperature where desired and furthermore, by fixing the oxygen before it reaches the melting zone, reduces oxidation.

♦ ♦ ♦

Recently the Bakelite Corp. pointed out: The fact that many of the new articles are being welcomed with hoarded dollars is excellent proof that good design is a healthy sales tonic. It is paying industry to have its face lifted.

♦ ♦ ♦

IN A prominent Midwest foundry the pipes carrying compressed air to the traveling type molding machines are laid under the floor with a suitable hose connection extending upward to the floor level close to one end of the sand heap. The long air hose is coiled upon a reel attached to the molding machine and automatically pays out as the machine moves from one end of the heap to the other in putting up the day's work. This form of installation eliminates cumbersome over head piping and the awkward loops of suspended hose.

♦ ♦ ♦

A rapid method of preparing polished specimens of iron for examination and photomicrography has been developed in the laboratory of one of the prominent automobile manufacturers. The time has been reduced to a few minutes for each specimen, and in addition the polishing operation does not tear out any of the graphite as in other methods practiced up to the present.

♦ ♦ ♦

A foundry recently encountering porosity in small castings solved the difficulty through X-ray examination and changes in gating methods. Since a marked difference in weight was noted between the sound and the porous castings, the company now weighs each casting as it passes through the inspection department to check against the return of the difficulty.

♦ ♦ ♦

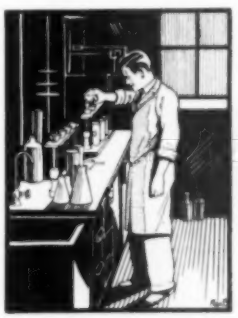
CAST iron cooling coils recently substituted for steel pipe coils in by-product coke plants provided several advantages. Initial construction cost was less, space occupied was reduced, less cooling water was required, the special design resulted in the cleaning costs being cut practically in half, minor repairs practically were eliminated and the replacement cycle was extended to about 10 years. Ground areas required by equivalent units to handle 100 gallons of oil per minute are 292 square feet for the pipe coil and 56 square feet for the cast iron unit. Steel pipe required 2067 cubic feet and cast iron 359 cubic feet.

♦ ♦ ♦

Steel castings containing 1.50 per cent chromium and 0.60 per cent molybdenum have found considerable favor for use at high temperatures and pressures.

♦ ♦ ♦

Novelties which will be sold in Chicago this summer in connection with the Century of Progress will provide a market for numerous types of castings. A case in point is the



toy bus recently introduced, which is cast in iron to resemble in great detail the large, open air busses which will operate through the Fair grounds.

The FOUNDRY Family Photograph Album

Upper Left
H. F. POPE
National Malleable & Steel Castings Co.
Cleveland

Upper Right
D. M. WHYTE
Cooper Bessemer Corp.
Grove City, Pa.

Lower Left
L. J. BRIGGS
Bureau of Standards
Washington

Lower Right
F. J. WALLS
Wilson Foundry & Machine Co. Pontiac, Mich.

Men of Industry

Whose Activities Are Making Foundry History

FRED J. WALLS, (See Family Album, opposite page) recently installed as president of the Detroit Foundrymen's association, has been associated with the Wilson Foundry & Machine Co., Pontiac, Mich., since 1915 and has occupied the position of metallurgist with that company since 1923. Mr. Walls is a native of Oakland county, Mich., and attended the University of Michigan, Ann Arbor, Mich., specializing in metallurgy. He then was connected for a period with the Packard Motor Car Co., Detroit, and the Consolidated Mfg. Co., Toledo, O.

Mr. Walls has been active in association work, and in 1930 was the author of the annual exchange paper presented before the Institute of British Foundrymen. His paper discussed "Briquetting of Cast Iron Borings for Use in the Cupola." He is a member of several A. F. A. committees including the gray iron castings committee, the subcommittee on recommended practice for cupola operation and the committee on recommended analysis of classes of gray iron castings. He is also a member of the American Society for Testing Materials and the American Society for Steel Treating.

✿ ✿ ✿

E. V. RONCERAY, immediate past-president, Association Technique de Fonderie, Paris, was presented the insignias of officer of the Legion of Honor by Mr. Luc, director of technical education, previous to the annual general meeting of the association. A large number of prominent industrialists, members of the foundry technical association, colleagues, and past and present students of Mr. Ronceray were present.

✿ ✿ ✿

DR. W. H. HATFIELD, director, Brown-Firth Research Laboratories, Sheffield, England, and technical adviser to Thomas Firth & John Brown Ltd., was awarded the Bessemer gold medal for 1933 at the annual meeting of the Iron & Steel institute in London on May 4.

Doctor Hatfield, who was Mappin medallist and associate, Sheffield University college in 1902, began his works career in the laboratory of H. Bessemer & Co. Ltd. After 2 years he became associated with Meadow Hall Works of J. Crowley & Co., subsequently joining the board of that company as technical director. In 1915 he assumed control of the Brown-Firth Research Laboratories and was adviser to Thomas Firth & Sons Ltd., and John Brown & Co. Ltd., the latter companies being merged in 1930. He is the author of numerous technical papers and books, including *Cast Iron in the Light of Recent Research.*

✿ ✿ ✿

ALBERT WEBER, vice president Wilson Foundry & Machine Co., Pontiac, Mich., has been granted a temporary leave of absence from that company and recently sailed for Europe to occupy a position as consulting engineer on foundry matters for Andre Citroen Co., Paris, France. He will spend approximately six months in Europe.

Mr. Weber became connected with the Wilson Foundry & Machine Co. upon its organization 19 years ago, and previous to that time was with the Ferro Machine & Foundry Co., Cleveland.

✿ ✿ ✿

GEORGE ROBERT DELBART, author of Exchange paper of the French Foundry Technical association, which will be presented at the annual meeting of the American Foundrymen's association, is an engineer attached to the management of Ateliers des Anciens Etablissments Cail. Mr. Delbart was born at Anzin, France, in 1899. At the end of the war he was permitted to interrupt his military service and enter the University of Lille, from which he was graduated as master of science and chemical engineer. In 1922 he became connected with the Cockerill works and the works of Ougree-Marihaye in Belgium. Later he accepted a position in the Usines a Tubes de la Societe d'Escaut et Meuse at Anzin, where he was appointed chief of the laboratories of mechanical, physical and chemical testing. During that period he completed his scientific studies and obtained his degree of doctor of science with the presentation of a thesis entitled: "Contribution to the Study of Cold-Drawn Steel. Comparative Study of the Corrosion of Cast-Irons."

In 1927 Mr. Delbart was appointed director of the laboratories of Anciens Etablissments Cail at Denain and later became head of the open-hearth steelworks department. At present he has charge of the metallurgical control of production and the study of new metallurgical developments. He is a laureate of Societe Industrielle du Nord de le France and has presented a number of papers to the Academie des Sciences of France.

Traces History Of Steel Castings

Major R. A. Bull, director, Electric Steel Founders' Research group, addressed members of the Chicago Foundrymen's club at the monthly meeting May 4 at the Great Northern hotel. The speaker described the developments that have taken place in the production of steel castings since the inception of the industry with particular reference to alloys. Tracing the history of steel castings Major Bull pointed out the influence that wars have had upon the perfection of different analyses of steel as well as production and heat treating practices.

Progress in methods of heat treatment has been an important factor during recent years in the improvement of physical properties of steel castings, considerable of that work had its inception during the world war, he stated. War requirements also were credited with development of numerous alloys, and whereas in 1900 the varieties of alloy steel castings numbered only five, this figure since has increased to 65 or more. Discussing heat treatment of alloy steels Major Bull cited the changes that occur in physical properties as a result of variations in temperature and pointed out that relatively wide temperature ranges may prevail in various portions of some heating furnaces.

Reader's Comment

Interesting communications from readers of The Foundry

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Leadership

TO THE EDITORS:

The sophistry contained in the communication of a "Small Foundry Owner" on page 28 April issue of THE FOUNDRY is deep seated and charged with an economic condition which the larger foundry industry, for several years up to 1930 and 1931, had come to believe would never be resurrected.

I refer more particularly to the past relative position of the small and medium bench and floor foundries in their combat with the fast growing mechanized production foundries which sprang into existence practically in "mushroom" time to meet mass production of castings.

This condition created *hard sledding* for the small foundryman, and he gradually found his position slipping back from important work in which there was a fair profit to more or less unimportant or mediocre work in which there was scant profit and limited production.

This situation created in the mind of the smaller foundryman the idea that he had been relegated to the *forgotten man* class. Therefore, he gradually withdrew from the get-together associations which were largely manned and steered by the larger foundrymen and decided to play the part of a *lone wolf* in his search for business.

Conditions which have grown more acute since 1930 and 1931 have become more favorable to the small and medium foundryman by reason of minimum overhead, plant equipment, etc., compared with the so-called production shops. The result has been that he has re-entered the field of keen competition in producing the more important type of castings. This, in turn, has spurred the production shops to reduce their prices—the final result being more or less of a price war in all directions and a general demoralization of the trade.

What the industry needs, I believe, is a concerted resolve by large, medium and small representative foundrymen to jointly enter into the study and practical application of the six-point suggestions stressed by the "Small Foundry Owner." There is just so much business being offered under present conditions—why not resolve to get cost, plus a reasonable profit, thereby establishing a high standard to which the gray iron foundry industry is entitled in the industrial field?

As conditions exist today buyers in general naturally and justly think that the gray iron foundry profession is comparable to a ship without a rudder, therefore insist on and obtain their castings below cost of production in many instances.

The profession does need leadership—but a leadership drawn from the smallest to the largest foundry with a sense of cooperation that will be genuinely regarded and faithfully executed.

Y. A. DYER
Hammond Iron Co., Birmingham

Melted Steel

TO THE EDITORS:

The following paragraph from a recent issue of the *Enquirer-Sun*, Columbus, Ga., dealing with events of nearly half a century ago seems apropos in connection with certain recent articles in THE FOUNDRY touching on early steel melting history:

Older citizens recall Robert E. Masters, a former resident of this city, who had the distinction of having produced at a Columbus plant the first steel castings of record.

The achievement was described by Henry Grady, famous editor of the *Atlanta Constitution* in 1884 and received wide publicity. In part Mr. Grady wrote as follows:

Mr. Robert E. Masters, who has charge of the molding department of the Columbus Iron Works, has succeeded in accomplishing that which has never before been done in any foundry in this country. When he took charge of the works, he found in a huge heap, hundreds of tons of steel scrap, the thin, light trimmings from the slab, for which no bid from rolling mills would pay for labor loading and freight.

Mr. Masters says necessity was the mother of his conceiving the idea of melting these scraps in an ordinary cupola, but when he mentioned it to old molders in the establishment they only had an incredulous smile at what they believed to be an impossibility. Using a percentage of steel in cast iron mixtures is about as old as the foundry business. Mr. Masters had used as high as 40 per cent in a 30,000-pound casting, but this immense pile of steel scrap was being added to every day, and to get rid of it his ambition was to use it up in serviceable castings *without any cast iron in the mixture whatsoever.*

However, he made experiments in a separate cupola from that used for the regular daily heats of cast iron, and soon ascertained the heat necessary to render the steel fluid enough to run the molds, after which heats of 2 and 3 tons were taken off daily in suitable castings. The metal as it flows from the cupola is a beautiful bright color and throws off an abundance of sparks, gives a clean drop and leaves the cupola and ladle in far better shape than cast iron does. *The Constitution* has been deeply interested in this work, because melting steel in this way was a thing heretofore unknown in the history of American foundries.

The *Scientific American* referred to the work as a "Mechanical Triumph." Thomas D. West writing in the *American Machinist* said "The melting of steel *alone* in a cupola by Robert E. Masters is, as far as I know, original with him and he has done a good thing in bringing this subject of steel melting in a cupola so prominently before the country, etc., etc."

Day and Carter, owners and editors of *The Iron Trade Review* (now *Steel*) wrote me in part, as follows: "You may be interested in knowing that our article on your steel melting process was copied by the *Iron Trade Journals* of London, England and Glasgow, Scotland."

ROBERT E. MASTERS
4045 *Eagle Street, San Diego, Calif.*

Quad City Group Hears Talk on Control

R. J. McSherry, Studebaker Corp., South Bend, Ind., addressed the regular meeting of the Quad-City Foundrymen's association, held Monday, May 15, at the LeClaire hotel, Moline, Ill. Speaking on the subjects "General Foundry Practice" and "Control by Budget," Mr. McSherry stressed the point that management of the large corporation or foundry, or of the smaller plant, both face the same problem. Good housekeeping, good organization and control were cited as the essential phases of successful foundry operation. Of the three, he considered good housekeeping the most important. Under that heading he included cleanliness, less waste and less danger of accidents.

The annual picnic of the association will be held on June 15 at Hotchkiss camp on Rock River.

Consolidate Purchasing

The purchasing department of the Caldwell-Moore plant, Link-Belt Co., Chicago, has been moved to the company plant at 300 West Pershing road, Chicago. Henry M. Coen is purchasing agent.

THICK WALLS

with smooth dense surface

-a job for Mayari

HERE are castings of a type that often gives the foundryman a lot of grief.

The castings are rolls for tar-paper machinery. These rolls have very thick walls and—here's the catch—the surfaces must be extremely close-grained, free from pores, machinable to a glass-like finish.

A tall order. But the Fearon Foundry Company, Chicago, makers of these castings, using a small addition of Mayari Pig Iron in the cupola mixture, produces rolls that meet all the specifications. In spite of their heavy walls, the castings have the fine, dense surface that is required, and machine to a highly-smooth finish.

In this case Mayari is used because it offers a way to obtain fine-grain structure and freedom from pores, gas pockets, and other surface imperfections. But Mayari brings about other improvements, too. Much greater strength. Higher resistance to heat and wear. Better machining qualities.

Mayari Pig Iron is simple to use, and very economical. By the addition of a small percentage of Mayari to the cupola mixture you can make fine alloy-iron castings, castings that are stronger, better in every way—and with an increase in cost so slight as to be almost negligible.

BETHLEHEM STEEL COMPANY
GENERAL OFFICES: BETHLEHEM, PA.

BETHLEHEM STEEL

District Offices: New York, Boston, Philadelphia, York, Wilkes-Barre, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Cincinnati, Indianapolis, Detroit, Chicago, St. Paul, Milwaukee, St. Louis, Houston, Dallas. *Pacific Coast Distributor:* Pacific Coast Steel Corporation, San Francisco, Los Angeles Portland, Seattle, Honolulu. *Export Distributor:* Bethlehem Steel Export Corporation, New York.

A. F. A. Awards Seaman Gold Medal To Guilliam H. Clamer

GUILLIAM H. CLAMER, president and general manager, Ajax Metal Co., Ajax Electric Furnace Corp., Ajax Electrothermic Corp., and Ajax Electric Co. Inc., has been recommended by the board of awards of the American Foundrymen's association to receive the Joseph S. Seaman gold medal of the association for his outstanding achievements in the casting industry. This recommendation has been approved by the board of directors and the presentation will be made at the annual business meeting during the Chicago convention.

Mr. Clamer was born in Philadelphia, June 9, 1875, attended public school in that section of Philadelphia known as Tioga, and in 1888 he entered Manual Training school, one of the two high schools in the city and one of the few schools teaching manual training in the country. After graduation in 1891, he undertook a post graduate course in electricity, and when later in the year the professor became ill, Mr. Clamer was engaged to substitute for him, this work extended over several months. This experience developed the opportunity of teaching in outlying high schools, and he taught mechanical drawing in three such schools for a year, dividing his time.

He then entered the private chemical laboratory of Dr. F. A. Genth, one of the most noted mineral chemists in America and previously head of the chemical department at the University of Pennsylvania. A short time later Dr. Genth died and Mr. Clamer then entered the sophomore year at the University of Pennsylvania in the department of chemistry, and gradually worked into the regular course, graduating in the class of 1897 with the degree of bachelor of science in chemistry.

After graduation he established a chemical laboratory at the Ajax Metal Co. Since, as far as could be determined, this was the first instance of a chemist being employed regularly in the nonferrous industry, he found a virgin field and, as he modestly states, it was not difficult to display usefulness. Briefly, this followed along the following lines: Analyzing competitors' alloys, which were secret at that time; using scrap scientifically based on analysis instead of guess; checking purchases; and controlling manufacturing. Further work consisted in developing a series of alloys known as plastic bronze and containing between 20 and 30 per cent lead and between 4 and 7 per cent tin; accurate proportioning being based on an understanding of the copper-tin and copper-tin-lead diagrams as then known. High strength alloys of the manganese bronze type and many special alloys for service requirements were developed to meet consumer demands.

He also experimented with ferrous alloys and developed some interesting copper-nickel steels. These were used during the war in the manufacture of shells, gun carriage castings, etc. He also developed corrosion resisting ferrous alloys of high nickel and copper content. Alloys of that type, but containing chromium, also were produced and were found superior to those in which no chromium was used.

Use of scrap metals in the production of nonferrous alloys assumed commercial prominence at that time, because of the price differential as compared with making the alloys with virgin metals. This led to the invention of the refining process in 1901, for which Mr. Clamer was awarded the Elliott Cresson gold medal of the Franklin institute a few years later.

Mr. Clamer was the first member of the American Society for Testing Materials representing the nonferrous industry, and he was influential in the establishment of the first nonferrous committees. He has been chairman of various nonferrous committees, has represented the A.F.A. and also the Nonferrous Ingot Metal institute on the A.S.T.M. committees, and in 1918 served as president of the latter organization.

During the war, he was appointed by the American Foundrymen's association to represent the nonferrous foundry industry in connection with technical matters with the government. He also was vice president of the War Service association of the manufacturers of solder and babbitt metal during the war. He has held membership in the nonferrous technical advisory committee of the bureau of standards since it was organized about 20 years ago.

In addition to those activities already mentioned, Mr. Clamer is past president of the American Foundrymen's association, past president of the Institute of Metals, past president of the Mining and Metallurgical section of Franklin institute, charter member of the American Electrochemical society, one of the first American members of the British Institute of Metals, and member of the American Institute of Mining and Metallurgical Engineers, American Institute of Electrical Engineers, American Society for Steel Treating, and British Iron and Steel institute. On June 5 of this year, the honorary degree of doctor of science was conferred on Mr. Clamer by Ursinus college, Collegeville, Pa.

He first entered the electric furnace field by becoming interested in an invention of Dr. Carl Hering, a brother of Dr. Herman Hering, his teacher in Manual Training school. This connection led into an extended field of research and development of

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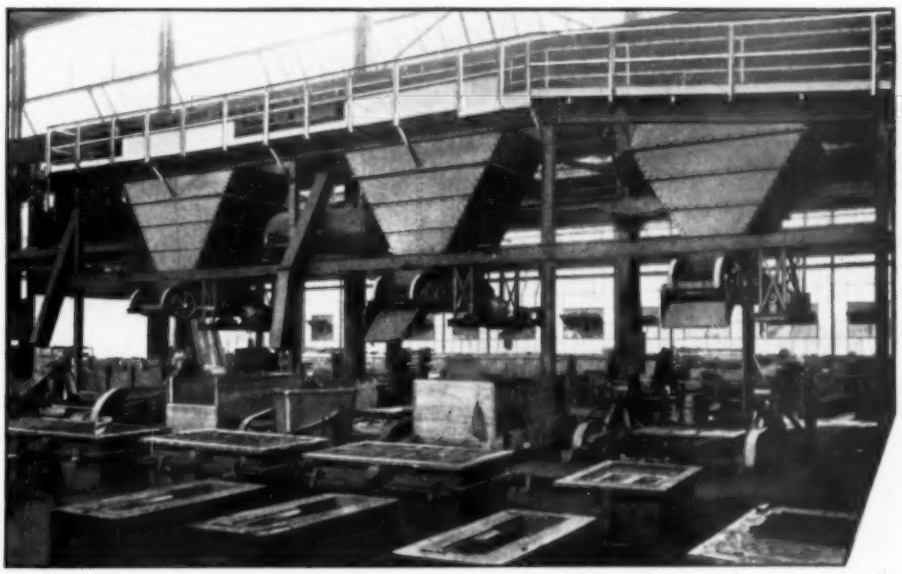
Answers



To your Foundry Questions!

WHAT about prices? . . . steel production . . . ferro alloys? What about railroad work? How does inflation affect me? These are some of the questions you have. • What about the proposed new legislation to stabilize prices and wage scales thoughout the industry? What will happen to "high cost" and "low cost" foundries? What should I do? What benefits will I receive if I put in mechanical handling equipment? How much will it cost . . . what kind should I install? These are some more of the questions you have . . . questions our engineers are accustomed to answering. • Whether it's an extensive sand handling and conditioning installation or a simple overhead hopper, you'll find our suggestions just suited to the size of your plant and the type of work you are doing. Small investments often make tremendous savings in plant operation. An interview incurs no obligation. Write us today . . . or if you prefer, look us up at the Foundry Show . . . Booth 82.

THE C. O. BARTLETT & SNOW COMPANY, *6201 Harvard Avenue, Cleveland, Ohio*

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BARTLETT-SNOW

DESIGNERS AND MAKERS OF FOUNDRY EQUIPMENT

(*Concluded from page 54*)

the induction type of furnace, which has produced remarkable changes in the melting practice in brass mills both in this country and abroad. Much of the research work of James R. Wyatt and Dr. Edwin F. Northrup and their assistants has been made under the executive direction of Mr. Clamer.

Numerous papers covering alloys, metallurgy, bearings, electric furnaces, etc., have been presented by Mr. Clamer before various technical organizations.

Polish Specimens Of Iron for Examination

Two new methods of polishing graphitic irons for metallographic examination, which eliminate imperfections previously produced have been developed under the auspices of the American Gas association at the University of Michigan, Ann Arbor, Mich.

Polishing of gray and malleable cast irons for metallographic examination at high magnifications formerly presented considerable difficulty. The graphite constituent being friable and comparatively soft had a tendency to be pulled out. This resulted in the rounding down of the metal at the edge of the graphite. For example, the graphite in malleable iron frequently assumes a crab-like shape but upon polishing the specimen by the usual powder-and-water methods appears roughly circular under the microscope. At high magnification, it will be found that the area in immediate contact with the graphite has been worn away to such an extent that it is entirely out of focus. In addition the color of the graphite will appear to be black, whereas, its color actually is gray. New methods of polishing differ only in preparatory procedure and do not tear out the graphite and permit the making of satisfactory micrographs at 1000 diameters or higher.

The methods which proved successful contain significant features of the methods of Burgess and Vilella, Wohrman, and Herty for polishing steel for examination of nonmetallic inclusions. The principal point in the methods is the avoidance of the use of loose powder abrasives and water. Instead, jewelers' rouge which consists of rouge cast in a stearic acid base is used. Sufficient water is used to act only as a lubricant.

One of these methods is as follows: 1. Very light grinding on a fine emery wheel; 2. Grinding at right angles to the direction of the previous operation on a No. 1 French emery paper; 3. Same with 0,000,000 and 0000 papers successively; 4. Removal of the last scratches on a used 0000 paper which has been glazed over by application of a stick of graphite; a graphite electrode will serve satisfactorily; 5. Polishing on a disk covered with a good grade of billiard cloth, moistened and charged with fine jewelers' rouge. Water is dropped constantly on the disk and in quantities sufficient only to act as a lubricant.

The other method was developed in the course of an investigation on short-cycle malleable iron sponsored by the Committee on Industrial Gas Research of the American Gas Association. It differs from the previously mentioned method in the fact that steps 2, 3 and 4 are replaced with treatment on the face of a leather wheel. A glued sheepskin wheel such as used by electroplaters, 8 inches in diameter with 1-inch face and rotated at 1750 revolutions per minute is used. In detail the method is as follows: 1. Very light grinding on a fine emery wheel; 2. Polishing on a leather wheel charged with "stainless steel buffing compound," a mixture of alumina and pumice cast in a stearic acid base; 3. Polishing on a leather wheel or on a disk covered with billiard cloth, either one charged with "chrome plate buffing compound" which is alumina cast in a stearic acid base. If the disk is used, water is dropped on sparingly; 4. Polishing on a disk covered with billiard cloth and charged with jewelers' rouge, cast in stearic acid as above.

Cupola Refractories Simplification Proposed

The department of commerce, bureau of standards, recently has prepared a proposed simplification of cupola refractories which is being submitted for the consideration of producers and users of that product, with a view of securing their approval. The present report includes a new draft of the proposed simplified practice recommendation which was found desirable following comments received on the original proposal.

It is pointed out that the recommendation is based on a careful survey of existing conditions and requirements, but will be reviewed one year after the effective date and annually thereafter. It thus may be modified when advisable to meet the changing conditions and new trends in the industry. Producers, users and others interested are requested to send comments or suggestions to the department.

Acquires License To Manufacture Facings

Penn-Rillton Co., 539 West Twenty-seventh street, New York, and mill at Irwin, Pa., has acquired exclusive manufacturing and sales license for the facings and partings formerly manufactured and sold by Kelly Graphite Mills, Stockertown, Pa. These products will be sold through the S. Obermayer Co. and Whitehead Brothers Co.

Book Review

Job Insurance, by John Bertwell Ewing, cloth 263 pages 6x9 inches, published by the University of Oklahoma Press, and supplied by THE FOUNDRY, Cleveland, for $2.50 plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

While European countries have gone a long way in the application of social insurance, only one state, namely Wisconsin, has passed laws with the idea of protecting the worker against the hazard of unemployment. The Wisconsin unemployment compensation act, which goes into effect on July 1, 1933, unless 175,000 workers are covered by voluntary plans in the state, attacks the problem from the standpoint of prevention. On the other hand a bill recommended by the Ohio commission on unemployment insurance, appointed by Governor White, places emphasis on relief. This subject now is being considered by the Ohio legislature.

Other states are considering the problem, and at the same time numerous plans have been advanced by companies and groups, including the Rochester plan, the General Electric unemployment pension plan, the National Electric Manufacturers' association unemployment insurance plan, the share-work plan, the New Hampshire plan, the voluntary unemployment benefit plans in Wisconsin, etc. Each plan approaches the problem differently.

The author has discussed the development of unemployment insurance in Europe and this country, has detailed the situation in Wisconsin through the period previous to the passage of the unemployment insurance bill, has discussed the various plans which have been given some degree of prominence, and has dwelt in some length upon the question of whether the attack on unemployment shall be based on the premise of relief or prevention. The study also includes observations upon the effect of job insurance on the employer. It would seem that those favoring the measure argue the employer must assume more responsibility in the care of the unemployed and plead relief for the farmer and small home owner in securing support for the measure.

Made Branch Manager

Harold B. Madison has been appointed eastern branch manager of the Clark Tructractor Co., Battle Creek, Mich., with headquarters at 467 Canal street, New York. Mr. Madison has been connected with the Clark company for 12 years and recently has been in charge of surveys of material handling problems and installations.

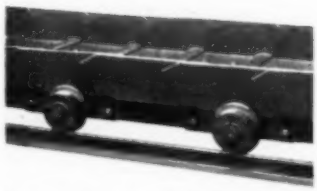
Let These LINK-BELT Units Help Cut Your Costs

Portable Sand Preparation Unit.

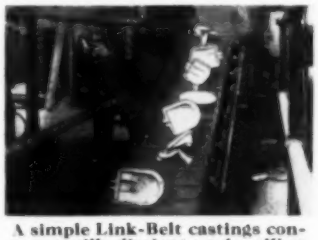
Continuous pouring on a Link-Belt mold conveyor.

Belt conveyor handling sand to molding line.

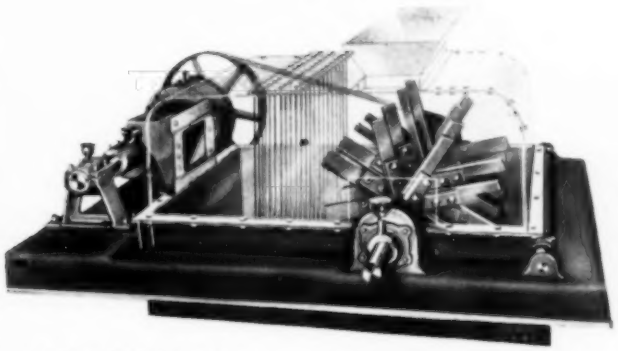
Paddle Mixer.



The "no leak" type apron conveyor.



A simple Link-Belt castings conveyor will eliminate rehandling and cartage.



Above: Showing the relations of the receiving hopper, beater arms, and steel rods against which the sand is driven in the standard Link-Belt Revivifier.

Right: The new Link-Belt "Junior" Revivifier.

The Sand Revivifier

THE Link-Belt Revivifier meets today's requirements for low-cost sand aeration. It is a heavy-duty, high capacity unit, designed and built to stand up under continuous operation with a minimum of maintenance. Mixes, aerates, and "fluffs" prepared sand, producing a sand heap with the right "feel". A sand that will ram to even, uniform density in the mold, which is so essential in the production of good castings. A revivifier is also an effective medium for lowering the temperature of hot sand, and is especially designed to break pellets and sand balls.

Send for Book No. 1090, Link-Belt Foundry Sand, Mold and Castings Handling Equipment.

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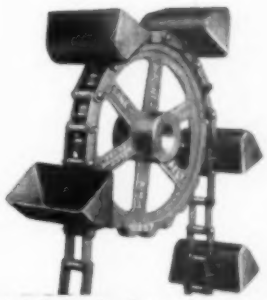
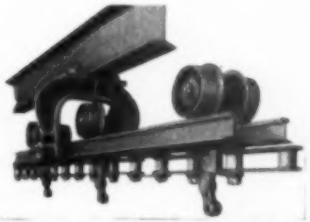
LINK-BELT

See Our Exhibit at A Century of Progress, Chicago



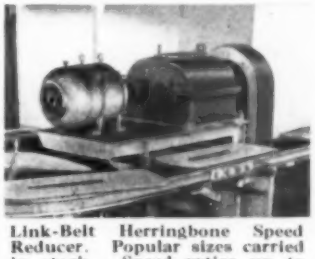
Link-Belt bucket elevators — chains, wheels, buckets of all types and capacities.

Instantaneous delivery of prepared sand to molders from overhead hoppers.



Double-rail track mounting of Link-Belt overhead conveyor.

Shakeout costs have been reduced in this shop by the Link-Belt vibrating shakeout riddle.



Link-Belt Herringbone Speed Reducer. Popular sizes carried in stock. Speed ratios up to 300 to 1.

Exhibit Equipment in London

International Foundry Trades exhibition includes numerous interesting developments

INTERNATIONAL Foundry Trades exhibition held at Royal Agricultural hall, London, from April 24 to May 3 was particularly interesting as no exhibition of that description had been held in Great Britain since 1929. Foundry Trades Equipment & Supplies association was responsible for holding the exhibition, which was organized by F. W. Bridges & Sons, Ltd.

On the opening day, the organizers gave a lunch, at which the principal guest was Sir William J. Larke, director of the National Federation of iron & Steel Manufacturers. In proposing the toast of the Foundry Trades Equipment & Supplies association, Sir William said that, in his opinion, the foundry industry of Great Britain was second to none from the point of view of technological progress. He said that in the present time of stress, it is an urgent necessity to organize the national industries, and that with this object in view, individual competition must give way to a large degree of cooperation, and that production costs must be reduced. He added that once the industry of the country has reestablished itself on a profitable basis, the time will come to co-operate also with other countries.

The exhibits shown can be conveniently divided into the five main sections: foundry plant and equipment; furnaces; foundry supplies, refractories and sands; optical instruments and testing apparatus; miscellaneous. A conveyor of the continuous type without gaps between the plates supporting the molds was shown by Foundry Equipment, Ltd., 15, Westminster, London. On the same stand were a number of molding machines, including one hydraulic machine, designed primarily for flat and shallow castings. This machine is fitted with an under-sand frame, which avoids the necessity of tucking sand by hand under the bars generally used in the flasks.

The display also included a hydraulic machine for making deeper work, the pressure being applied from the bottom; a hydraulic roll-over machine and a hydraulic machine with a rotary table providing two molding stations; and a pneumatic jolt-squeeze machine which can be used for snap flasks. The jolt stroke is adjustable both for length and speed, and a double-faced aluminum pattern-plate should be utilized for operating this machine. The same firm also displayed a sand preparing plant.

Numerous Machines Shown

British Moulding Machine Co., Ltd., London, showed a snap flask molding machine, a hand-squeeze turn-over molding machine, and a hand-hydraulic turn-over machine. A facing-sand hopper in which the sand is filled automatically into the riddle and then automatically riddled on the pattern also was shown. This hopper riddles a predetermined amount of sand on the pattern. Gustav Zimmerman, Dusseldorf-Bath, Germany, whose London agent is the British Moulding Machine Co., Ltd., showed a shockless jolt molding machine of the single-column type. A valve, which is fitted inside the plunger, regulates the speed at which the pattern is drawn. The start of the pattern draw is slow and gradually increases in speed. A squeeze machine, a jolt and squeeze molding machine, and core blowing machine also were shown.

Constructional Engineering Co., Ltd., Birmingham, displayed the bottom section of a standard 4 to 5 tons per hour cupola, a spark arrester, a standard cupolette, a mechanical riddle, and a tumbling barrel. A feature was an oil-fired sand dryer, with a capacity of 3½ to 4½ tons of sea sand, having a moisture content of 10 to 12 per cent, per hour. The dryer is fitted with an oil burner.

Fordath Engineering Co., Ltd., Hamblet Works, West Bromwich, in addition to core compounds, showed a continuous plant for facing sand, composed of an elevator which brings the sand to the riddle, the sand then being dropped by gravity into a sand mixer combined with an aerator; the capacity of the plant being about 6 tons per hour. The firm also displayed a testing machine for core sands, giving tensile and transverse tests, and also multiple rotary core machines, hand and power driven.

Spermolin, Ltd., Halifax, Yorkshire, showed various core oils for every class of foundry work. They also exhibited a sand mixing machine in which the sand is rotated and conveyed to the center by right and left handed scrolls, working on a common shaft. A rotary core machine with a rising and falling tray carrier, which adjusts the tray to the exact level and parallel with the die, thus obviating the necessity of packing up the tray and eliminating bent and distorted cores, also was shown.

Bagshawe & Co., Ltd., Dunstable, Bedfordshire, showed a working model of a mold conveying and sand handling system for a mass production foundry, the model being about 13 feet in length. Sterling Foundry Specialties, Ltd., Bedford, had a comprehensive exhibit of their rolled steel flasks of various sizes and styles for iron, brass, steel and aluminum foundries; also a range of wheelbarrows suitable for foundry purposes. Tilghman's Patent Sand Blast Co., Ltd., Broadheath, near Manchester, showed a 30 x 36-inch sandblast tumbling barrel, a cabinet type sandblast apparatus, a sandblast cabinet with apparatus having an automatic sieving device, a rotary table sandblast machine with dust arresting equipment, and a display of air compressors.

Reavell & Co., Ltd., Ipswich, Suffolk, showed a wide range of air compressors, Spencer & Halstead, Ltd., Ossett, Yorkshire, exhibited cast iron and steel plate fans, a working model of their fan and dust filter, and a small sandblast cabinet. They also showed examples of wheelguard and dustcollecting hoods for fettling wheels. F. Gilman Ltd., 221 Smethwick, Staffordshire, displayed a full range of flexible drive machines applicable to grinding, drilling, sanding, and other processes which may be involved in the treating of castings.

Sir W. G. Armstrong, Whitworth & Co., Ltd., Newcastle-upon-Tyne, showed a photograph of its plant,

featuring a complete battery of pulverized rotary furnaces of Sesci type. The firm also showed a range of light weight pneumatic tools. On the stand were a number of castings made from the firm's new refined iron, including a turbine casting with sections varying from ⅞ to 3¼ inches. This firm also exhibited an oil-fired, noncrucible, semi-rotary furnace with a bottom pouring valve.

Morgan Crucible Co., Ltd., London, exhibited a wide range of crucibles, stands, basins, brazing pans, etc., and also their pyrometer tubes. In addition, they displayed various types of furnaces, including coke and oil fired crucible types. A display of various refractories was also shown. August's, Ltd., Halifax, Yorkshire, exhibited three sizes of a portable mold drier, a portable core stove complete with a 4-inch dial type thermometer, and various other types of furnaces. In the center of the stand was an intensive foundry sand mixer with inclined track bucket loader and aerator, the entire plant being direct driven. This machine was in operation preparing facing sand, loam, core sand, and reconditioning used foundry sand. The company also exhibited a core-making machine. William Cumming & Co., Ltd., Maryhill, Glasgow, Scotland, displayed an interesting small coke-fired furnace for crucibles of 80 pounds capacity, and fired with coke. This furnace is specially suitable for melting iron, lead, brass and alloys.

Nonferrous Shop Materials

Carborundum Co., Ltd., Trafford park, Manchester, displayed refractories including bricks, tiles, special shapes, tubes and muffles. They showed crucibles, designed for use in nonferrous foundries. William Cumming & Co., Ltd., Maryhill, Glasgow, Scotland, exhibited a wide range of materials for use in iron, steel and nonferrous foundries, including foundry blackings, plumbagos, coal dusts, core binders, etc. Thomas Wilkinson & Co., Ltd., Middlesbrough, Yorkshire, displayed foundry facings, coal dust, plumbago, core gum, silica flour, parting powder, and other foundry supplies.

General Refractories, Ltd., exhibited samples of molding sands; refractory cements; stoppers, nozzles and sleeves; ladle bricks; and silica bricks. Thomas E. Gray & Co., Ltd., 119 High Holborn, London, had built up a small furnace fitted with a No. 4 heat accumulator for the drying of cores and molds. This furnace is fitted with specially designed tuyere-type firebars. On the same stand were displayed samples of the firm's plastic refractory.

Robson Refractories, Ltd. Darlington, Co. Durham, exhibited a cupola and furnace refractory lining material; material for treating iron and steel ingot and casting heads, and furnace bars for various types of furnaces. It also showed a moisture tester, an oil-fuel burner, a display of insulating bricks and cement. Samples of fine graded sands were shown by Ryarsh Sand Co., Ltd., Ryarsh, Malling, Kent, and J. Parish & Co., Erith, Kent.

A self-indicating universal testing machine was exhibited by W. & T. Avery, Ltd., Birmingham. A large-diameter graduated dial on this machine gives visible indication of the load, which can be seen on both sides of the dial. The machine is made in capacities from 10 to 100 tons, and one operator can carry out any of the usual tests—tension, compression, transverse, bending and shearing. E. Leitz, London, showed a wide range of instruments, including a stereoscopic microscope body. This instrument is developed with a rapid magnification device, and magnifications range from 3.75 to 216. The company also showed a material-testing microscope with objective holder capable of being rotated through 180 degrees, with mechanical stage adjustable in height; a large metallographic microscope, with vibration absorbing device and vertical illuminator, interchangeable with new dark ground illuminator, which gives an image free from glare and haziness, etc.

Cooke, Troughton & Simms, Ltd., Westminster, London, showed a projection miscroscope, which is specially designed to withstand vibration without the use of shock-absorbing devices. This instrument examines specimen up to 50 pounds in weight. Carl Zeiss, Ltd., London, had a varied display of microscopes, magnifiers, refractometers, etc. A novel feature was a stand specially designed to permit observation under conditions as comfortable as possible. Chas. Hearson & Co., Ltd., London, exhibited microscopes. One instrument exhibited for the first time in Great Britain, is adaptable for both direct observation and photomicrography, with all adjustments disposed so as to render the apparatus capable of handling problems in metallurgical research of the most complicated character. This firm also displayed electric furnaces, tube and muffle types for temperatures up to 1000 degrees Cent., and for the determination of carbon in steel, general heat-treatment of metal, etc., and temperature-recording equipment and thermostats.

Imperial Chemical Industries, Ltd., London, displayed sodium carbonate and fused sodium carbonate blocks for use in gray iron and malleable iron foundries. Ridsdale & Co., Middlesbrough, Yorkshire, showed a range of British chemical standards in the form of standard analyzed samples of a large variety of materials which can be used for purposes of comparison in laboratory practice.

Leopold Lazarus, Ltd., London, exhibited briquets of silicon, manganese and chromium. Major, Robinson & Co., Ltd., Cornbrook, Manchester, displayed iron and steel cements specially graded to suit the requirements of foundries; also pipe and tube bending machines, leather dressings, and aluminum filling for aluminum castings. Welsh Navigation Steam Coal Co., Ltd., Cardiff, Wales, showed samples of foundry coke. William Baird & Co., Ltd., Glasgow, Scotland, exhibited samples of foundry pig iron, and coke.

Special Pig Iron

United Steel Companies, Ltd., Workington, Cumberland, exhibited samples of hematite irons, refined irons for all purposes, together with samples of foundry and malleable castings. Bradley & Foster, Ltd., Darlaston, Staffordshire, showed a range of samples of refined pig iron, including degasified cylinder iron produced by a process in which the molten metal is stirred and agitated while in the receiver. Stewarts & Lloyds, Ltd., London, displayed various samples of pig irons for high-class engineering castings. Atlas Preservative Co., Ltd., Erith, Kent, showed various rust-proof paints for iron and steel products. Barrow Hematite Steel Co., Ltd., Barrow-in-Furness, displayed samples of hematite pig iron, including special qualities for the manufacture of rolls and cylinders. H. G. Sommerfield, Ltd., Carterhouse Square, London, exhibited examples of industrial goggles, respirators, and other protective devices.

Mond Nickel Co., Ltd., Millbank, London, exhibited a large rotating chart indicating suitable mixtures of nickel cast iron for various purposes, and also giving their more important properties. Colville's Ltd., Glasgow, Scotland, displayed a number of samples of refined, special, and ordinary hematite irons. W. T. Nicholson & Clipper Co., Ltd., Salford, Lancashire, showed various machines for jointing belts, tools for filing and cutting leather and various types of belts.

Grant & West, Ltd., London, exhibited samples of metal-to-metal jointing material in powder form, compound for belt treatment and for the treatment of steel wire ropes, metallic packing, tinning compound, aluminum solder, paint solvent, black varnish, and rust solvent. Quiksol Products, Ltd., London, showed samples of foundry flux, welding flux, solder and tinning pastes, tinning compound, and finely divided tin and lead. British Pigirons, Ltd., London, displayed samples of their special pig irons, together with fractures, test-pieces, etc. Four Oaks Spraying Machine Co., Sutton Coldfield, Birmingham, had a collection

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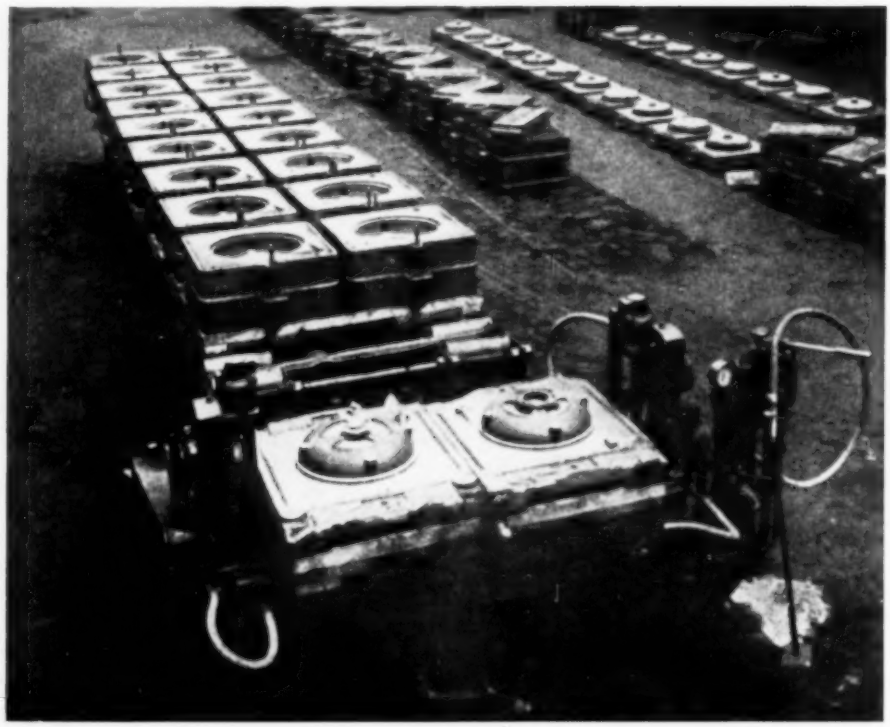
IF IT'S A HERMAN IT'S WORTH USING. IT MADE ITS WAY BY THE WAY IT'S MADE

HERMAN MOLDING MACHINES



Welcome

A cordial invitation is extended to visit our space, No. 40 at the exhibition of the American Foundrymen's Association. See the new 750 lb. Capacity Jarr Rollover in operation. Note its speed, its simplicity in design, its rugged construction. Built in sizes most suitable for your work.

The Herman Automatic Fluid Timing Valve will also be demonstrated. It will increase your production, make better molds at a lower cost.

HERMAN PNEUMATIC MACHINE COMPANY

GENERAL OFFICES: Union Bank Building PITTSBURGH, PA.
MANUFACTURING PLANT: ZELIENOPLE, PENNSYLVANIA, U. S. A.
Foreign Works: Pneulec Limited, Mafeking Rd., Smethwick, near Birmingham, England
Hartung Aktiengesellschaft, Berlin, Lichtenberg, Germany
Gibson Battle & Co., Limited, Sydney, N. S. W.

(*Concluded from Page 59*)

of spraying, limewashing and disinfecting machines for limewashing the walls of foundries, etc.

The technical committee of the Institute of British Foundrymen also arranged an exhibit showing melting furnaces, sands and refractories, cast iron, malleable iron, steel and nonferrous castings, in co-operation with the British Nonferrous Metals Research association, to illustrate the type of work the various committees are carrying out and the trend in foundry practice.

The British Cast Iron Research association also maintained an exhibit which included drawings and photographs of the balanced blast cupola, which has been developed by that group, information on the heat resisting cast irons originated by the association, and illustrations of plain and alloy cast iron containing various alloys.

Leaks in Air Lines Cause Considerable Loss

By George P. Pearce

Probably there is no other single item in the foundry where a greater saving can be made than in high pressure air lines. Managers and superintendents alike know the truth of this statement, but after vigorous campaign on air economy, the matter generally is considered settled and forgotten. Miscellaneous air leaks have a habit of gradually developing, and consequently the matter soon is as bad as ever.

Possibly the best method of spotting leaks is to run the compressor for an hour during the evening or on Saturday afternoon and have a man with good hearing take a walk through the shops and tie a red tag on every leak. It is highly important that the workman's hearing be unimpaired. Then every time a pipe fitter finds an opportunity, he can repair the leaks. This test should be made at least four times a year and in some shops oftener.

A particular instance is recalled where a workman in charge of some rattle mills fixed up a hose with a short piece of ⅜-inch pipe for a nozzle and connected it to a high pressure line. The hose was located behind his locker and was used to blow off clothes at night. The workman made the connection without the knowledge of his foreman and as he could not get a valve without an order he did it without one, simply doubling the hose and twisting twine around it to shut it off. Sometime later this man was laid off and in some manner the twine became loose and the hose straightened out and hung back of the locker, blowing at full force. The noise of the mills drowned the hiss and the pipe ran for several months before the leak finally was discovered. The loss amounted to over 25 horsepower continually wasted 9 hours per day.

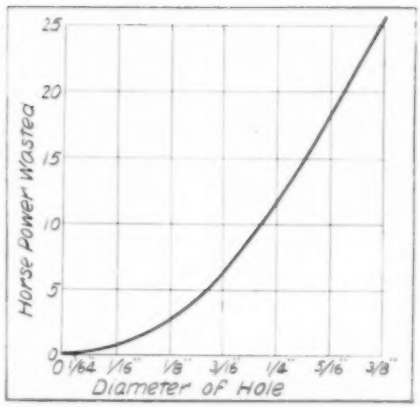


Chart showing the horsepower loss through leaks in the air lines

The chart shown in the accompanying illustration presents an idea of the power wasted by leaks of various sizes and is conservative for it makes allowance for the average drop in pressure along the lines.

Book Review

Die Casting Technique (Spritzgusstechnik), by Leopold Frommer, cloth, 686 pages, 6 x 9 inches, published by Julius Springer, Berlin, Germany, and supplied by THE FOUNDRY, Cleveland, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster.

Without doubt, this volume, written in German, constitutes one of the most exhaustive treatises that has been published on any manufacturing process, and is of particular interest due to the fact that the various phases involved in the manufacture of die castings mainly have been held as business secrets. A wealth of valuable information is available as the author discusses in detail the theory and practice of die casting. While the volume contains only eight chapters relating to the main divisions, each one is subdivided into sections covering features pertaining to the main chapter heading. The first chapter is entitled "Considerations of the Inflow Process and the Resulting Laws for Working Methods," and discusses nozzle effect, pressure of the stream, friction and eddy losses. "The Die Casting Die" deals with various parts of the die, basic principle for die design, air venting, etc. "The Die Casting Machine" covers parts, construction principles, construction of piston injection pumps, and construction of compressed air casting machines. Under "Arrangement of the Dies in the Casting Machine" the author describes the die support or carrier, the principal schemes of die carrier arrangement, control of the die motion, location of the die carrier on the casting machine.

"Die Casting Machines in Practice" describes machines with *hot* pressure chambers, and machines with *cold* pressure chambers. A chapter deals with die casting alloys and discusses the characteristic peculiarities of the die casting process and their requirements on the casting metals, and the present-day alloys for die casting. "Die Casting Practice" relates to the characteristic properties of die castings, and their relationship or dependence upon the casting conditions, and the typical defects of faulty cast pieces, their sources and their avoidance. Supplementary die data is provided and general principles, emission of an incompressible, friction-free fluid from a pressure chamber, pressure distribution in static streams or flows, motion process of piston injection pumps under quasistatic flow conditions, brake pressure at the end of filling the die, and the beginning and pressure processes in hydraulically operated hot-press casting machines are discussed. The latter machines are those which recently have come into use in making copper-base alloy castings, and differ from the regular die casting machines in that the molten metal is poured into an unheated (*cold*) pressure chamber, and then forced into the die by a piston operated hydraulically.

New Standards Published in Year Book

American Standards Year Book, recently published by the American Standards Association, records the establishment of 31 new national industrial standards during the past 12 months. The book is issued as a record of the co-operative achievements of nearly 3000 scientists and engineers representing more than 500 national technical and trade organizations in the development of a unified system of basic technical standards for industry.

The association also has published a booklet "Does Industry Need A National Standardization Agency?" outlining the performance of that organization as an essential function for American industry.

Hold Power Show

The 6th Power show will be held in the Exhibition hall of the Stevens hotel, Chicago, during Engineering Week, June 26-30. Nineteen engineering organizations are participating in the engineering week activities of the Century of Progress.

Moltrup Steel Products Co., Beaver Falls, Pa., has moved its New York office from 3314 to 702 Chrysler building.

Prevent Losses with

Proper Gates and Risers

By PAT DWYER

ONE method for gating and pouring a large, flat, thin aluminum casting was described in the May issue of THE FOUNDRY. A second method employed by another foundryman, who in addition to the usual hazards incident to handling a number of crucibles simultaneously was handicapped by lack of a sufficient number of men, is shown in Fig. 206.

This casting was one of four which, when machined and assembled, formed a vacuum pan 8 feet 4 inches wide, 12 feet 6 inches long and ¼-inch thick. A flange on the ends and sides was 2½ inches deep, ⅝-inch thick at the bottom and ⅞-inch thick at the top. The side flanges on the two center castings and on the inner side of the two outer castings were ⅜-inch thick on the bottom and ⅝-inch on the top. Each section of the pan was divided into six compartments by five ribs 25 inches apart. These ribs were ¼-inch thick at the bottom and ½-inch thick at the top. Flanges and ribs were flush at the bottom. The main problem was to prevent the castings from cracking or warping, particularly the two outer castings with a heavy flange on one side and a light flange on the other side.

After considering several alternative methods the foundryman in this instance decided to pour the casting *six up*, with two pots at each side of the flask and one at each end to insure a fast and uniform distribution of the metal. A continuous runner channel was cut in the drag at each side between the pattern and the side of the flask. A similar long runner was cut in the sand at each end of the mold. Thin, shallow branch gates about 4 inches apart carried the metal from the runners into the mold cavity.

The long runners and great number of thin gates served the double purpose of conducting the metal rapidly into the mold, and of preventing the casting from tearing or cracking during contraction which amounted to 2⅜ inches. Also the entrance simultaneously of metal from the ends and sides helped to equalize the cooling speed in all parts of the casting. In furtherance of this idea the sand was stripped from the runners and part of the heavy flange on the outside of the casting immediately after the metal solidified.

With only seven men available to handle the six pots, the pouring arrangement shown in Fig. 206 was adopted. Each of the six men manipulated the double end of a ladle shank while the single end rested on a piece of 2 x 4-inch scantling supported by the flask on one end and supported by a horse at the other end. At a given signal all pots were tilted simultaneosuly.

Many Methods Tried

THE first and therefore most important feature in molding an aluminum casting is to provide a gate that will admit the metal with a minimum amount of disturbance and friction and one which later will compensate for the shrinkage of the metal. Undue agitation tends to break the film of oxide which constantly forms on the surface and produces a drossy substance which later either mars the surface of the casting, or, lodging at some point in the body, constitutes a defective area. In some instances the dross may remain concealed and the foundryman is given no warning of his faulty gating practice. In others the defect comes to light only after the casting has been pressure tested, or after it has been machined.

Pour the Metal Fast

Although the probability of misconception may be remote, it may be well at this point to explain that when foundrymen speak of aluminum, they necessarily do not refer to the metal as an element or a metal in the pure state. In the foundry, the term aluminum covers every alloy in which aluminum is the predominating metal.

This is just another example of the laxity which prevails in practically every phase of foundry nomenclature. When and if the occasion arises the foundrymen definitely can explain every term he uses, still for all practical purposes his use of a general term usually is sufficient. In this respect he follows the custom of men engaged in any particular field. Except in isolated instances, his remarks either oral or written are intended for the ear or eye of men engaged in the same industry and these men automatically adjust their receiving apparatus. Thus when he speaks of aluminum without any qualifying description they assume he is referring to the ordinary commercial alloy known in America as No. 12, containing 92 parts aluminum and 8 parts copper.

To meet definite specifications, zinc, tin, manganese, silicon, copper magnesium and other metals in varying proportions may be alloyed with aluminum, but in nearly all instances the molding, pouring and gating features remain the same as for the ordinary or No. 12 alloy. Method of introducing the various alloys, melting and pouring temperatures, and types of furnaces best suited for the purpose are items—in many instances of personal preference and due to local conditions—which lie outside the scope of the present discussion.

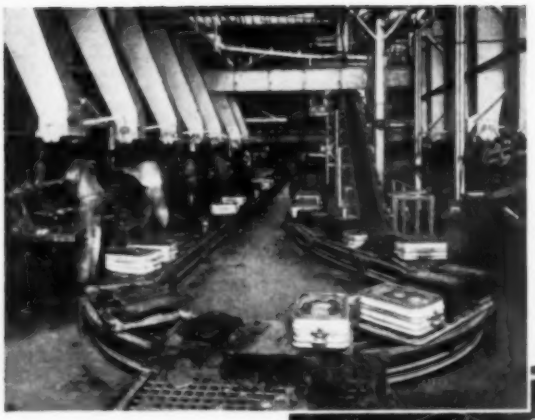
THE FOUNDRY in many former issues has presented articles by prominent foundrymen on the subject of gating aluminum castings. References and illustrations on this and succeeding pages are taken from an article by W. J. Clark which appeared in THE FOUNDRY issues of Nov. 1 and Nov. 15, 1927.

The first and therefore most important feature in molding an aluminum casting is to provide a gate that will admit the metal with a minimum amount of disturbance and friction and one which later will compensate for the shrinkage of the metal. Undue agitation of the metal tends to break the film of oxide which constantly forms on the surface and produces a drossy substance which later either mars the surface of the casting, or, lodging at some point in the body of the casting, constitutes a defective area and impairs the value of the resulting casting.

In some instances the dross may remain concealed and the foundryman is given no warning of his faulty gating practice. In others the defect comes to light only after the casting has been pressure tested or after it has been machined. An aluminum casting

(*Continued on Page* 64)

Trolley Conveyors

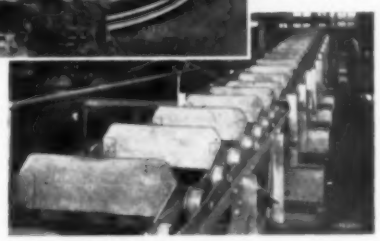


Mold Conveyors

Belt Conveyors

COMPLETE

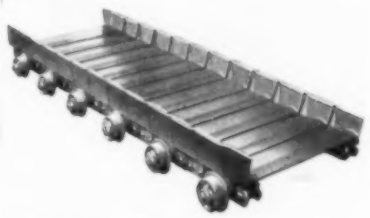
MECHANICAL HANDLING EQUIPMENT FOR FOUNDRIES



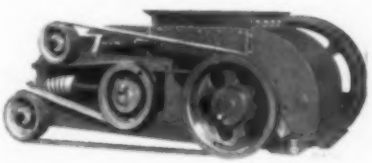
Scraper Conveyors

The number of foundries adopting mechanical handling methods today indicates the necessity of this type of equipment to effect savings in production costs.

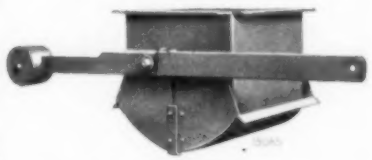
The extent of these savings depends upon the type of equipment selected.



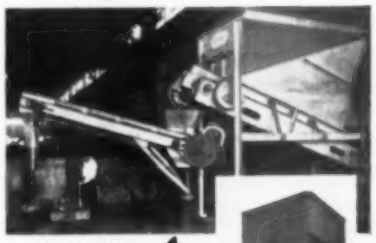
Leak-proof Apron Conveyors



Disintegrators



Foundry Type Valves



Flask Fillers

The Jeffrey line of mechanical handling equipment for foundries—both large and small—is complete. The list includes: Conveyors: Apron, Belt, Flight or Scraper, Flask, Mold, Castings, Trolley.

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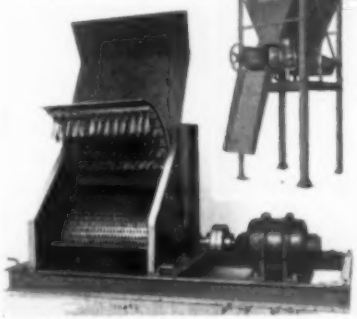
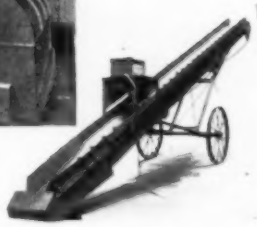


Aerators

Screens



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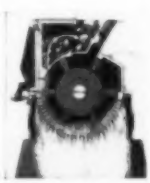

Pulverizers

Fans

JEFFREY

MATERIAL HANDLING EQUIPMENT

(*Continued from Page 62*)

should be gated in a manner to prevent turbulence of flow, high drop, or the mixture of swift currents of metal either in the gate passages or in the mold.

Although not actually necessary in many instances, sometimes it is advisable to place the mold on an incline and introduce the metal from the low side. This will check the velocity of the rising stream. Another method is to check the metal in the runner or gate before it enters the mold. This is done by reducing the size of the opening at some point between the sprue and the mouth of the gate.

Large flat castings usually are gated on opposite sides and the metal is poured from two or more pots or ladles. On molds of this kind the gates on opposite sides should be kept out of line to allow the opposing streams to pass each other instead of meeting head on and thus setting up agitation.

Gated at the Bottom

Deep molds preferably are gated as close as possible to the bottom so the metal may rise slowly and quietly. All types of bottom gates do not meet this requirement. A gate that serves satisfactorily on one casting may be entirely unsuitable on another. Shape, size and volume of the casting must be taken into consideration in designing the gate. Examples of the application of a bottom gate under varying conditions are shown in Fig. 207. A greater vertical drop than 2 feet is undesirable. If the total depth to the bottom of the mold is more than 2 feet the sprue *P* should be broken as at *B* to curb the speed of the falling stream. A check in the gate passage, as referred to previously, will set a further curb on the force of the stream entering the mold. Advantage of the relative position of this check is shown at *C* in the same illustration.

One of the cardinal principles to be observed in pouring aluminum or any other metal is to keep the sprue full. If the metal is checked at point *A*, the amount of metal entering the gates will not be sufficient to fill them and as a result the stream entering the mold will be slow and listless. The disadvantage is in proportion to the distance from the check to the point of delivery. For example, a check at *B* is preferable to a check at *A*. A check as at *D* is not recommended. Pressure from the sprue forces the metal violently through the thin gate *D* with a nozzle effect.

For the foregoing reasons it is advisable to arrange the check in the runner and not too close to the gate entrance as at *E*. An alternative method of checking the wildness of the stream is shown at *F*, Fig. 207. The metal rises a considerable distance from under the mold and enters through a comparatively large gate *G*.

Horn gates are employed extensively in aluminum molding practice. In the usual position the small end of the tapered horn gate is the delivery end. By reversing the gate shown at *H* to the position shown at *I* the situation is improved. Any impediment to the free entry of metal to the mold is an agitation factor. Generally speaking the metal current should be allowed to spend its force gradually and die away naturally. Where a stream of metal is directed against or impinges upon the wall of a mold or core a decided disturbance takes place with a consequent formation of dross. This point continually should be borne in mind, particularly in gating aluminum castings.

Generation of an undue amount of steam from the sand is a prolific cause of defective castings, usually found where too much metal is delivered over a given mold surface from a single gate. In the interest of mistaken economy this single gate is designed to serve both as gate and feeder. Exceptions may be noted, but as a general rule a number of small gates are preferable to a single large gate. A large casing cap cited as an illustration had to be scrapped on account of spongy metal in the vicinity of a single large gate. A satisfactory casting was secured when the metal was poured through four small gates.

While on the subject of casting defects caused by steam from the sand it is interesting to note that this form of defect—where other conditions are normal—may be prevented by air drying the surface of the mold, or by cautiously applying the flame of a blow torch to the surface. With some sands or in other exceptional instances a thorough skin drying may be advisable.

Before leaving the subject of skin dried or all dried molds it is pertinent to point out that the contraction of aluminum is approximately the same as that of steel ¼-inch per foot. Also, as with steel, the metal is exceedingly tender during the early contraction period and will crack easily under slight provocation. Where necessity forces the adoption of a skin dried or completely dried mold, the foundryman should hold the amount of bonding material to a minimum and construct the mold in a manner to facilitate the contraction of the casting.

Gate Is Not Cure-all

While it is true that a correctly designed and constructed gate is one of the most important factors in securing a perfect casting, it is not a cure-all. A perfect gate will not produce a saleable casting if other molding features are overlooked or neglected. Minor defects on certain parts of a casting may not affect the utility or appearance, but may cause the rejection of a casting if they appear on a machined surface. For that reason, wherever possible, the machined surface should be placed on the under or drag side.

In many instances this may not appear to be the most convenient position to mold the casting, but in the majority of instances it will be found to be the most economical. An output of 50 castings per day accepted by the customers costs less than an output of 100 castings where even half are rejected. In designing the pattern and equipment for the largest possible production the foundryman

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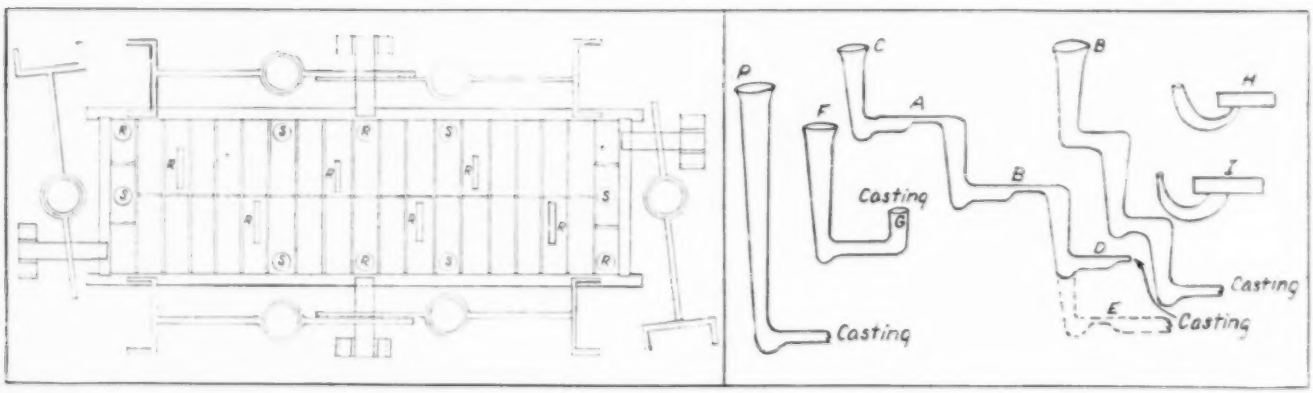

Fig. 206—The single ends of the six shanks were supported on horses to enable a small crew to handle the metal. Runners and risers are shown respectively by the letters S and R. Fig. 207—A check in the gate is advisable particularly on castings that are poured at or near the bottom

CHEATING THE SCRAP PILE

by using

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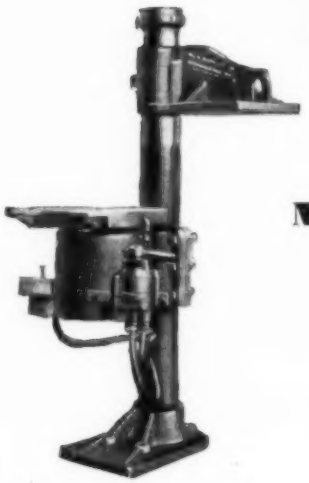
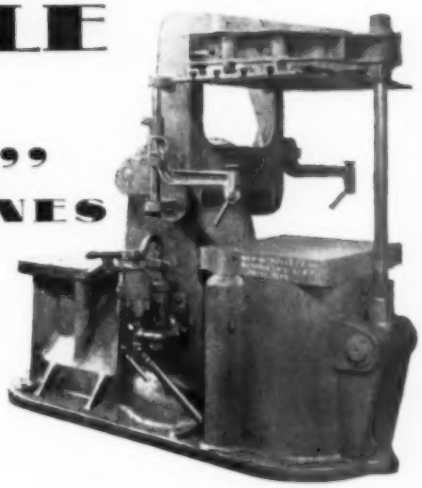


Type 10-F Combination Jolt Squeezer



21-R H Jolt Roll-over, squeeze and pattern draw

A comparison of records in some of the larger production foundries, after installing "NICHOLLS" Molding Machines, show a large reduction of scrap castings.

This, in addition to the greater number of castings produced per day, per man, has kept many a job out of the "red".

Over a period of years, "NICHOLLS" Molding Machines have gained the reputation of turning out the largest production of GOOD CASTINGS with the minimum of labor and maintenance.

Many of the world's foremost foundries where the largest daily productions of castings are made, buy "NICHOLLS" Molding Machines. In these shops where molding machines are given the severest tests "NICHOLLS" machines stand up and produce the scheduled number of good, uniform castings without interruption.

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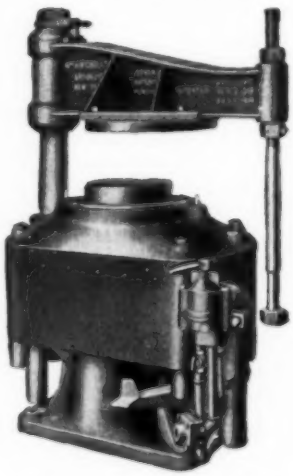
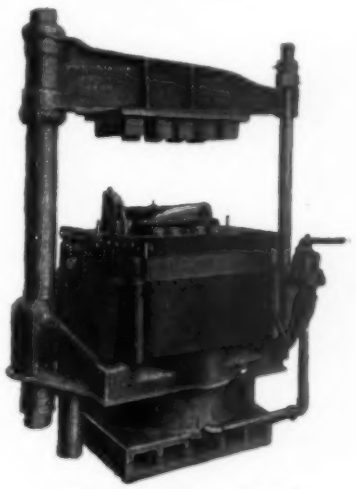
18-44 Type D Heavy Duty Jolt Squeeze, pattern draw, with flask roll-off



14-36 Type D Heavy Duty Jolt Squeeze and Pattern Draw



33-54 Heavy Duty Type D Jolt, Squeeze, Draw and roll-off

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(*Concluded from Page* 64)

should bear in mind that his profit comes from the number of saleable castings and *not* from the number of molds placed on the floor. One reasonably may expect to find a clean surface on the drag side of a casting. The element of risk from many causes lowers the probability of finding a similar surface on the cope side.

Experienced foundrymen will admit the advantages of bottom gating and of molding the finished face of the casting in the drag. However, they also will direct the attention of the beginner to the fact that a knowledge of these two factors is not enough in itself. Certain characteristics of individual castings also must be taken into consideration.

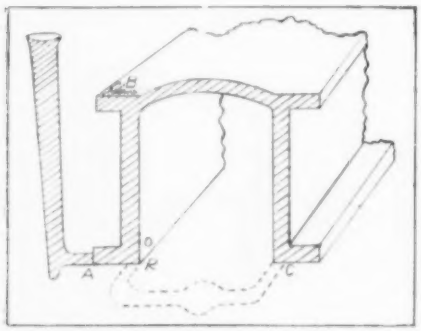


Fig. 208—The double gate R and C is preferable to the single gate A

This point is illustrated in Fig. 208, a large flanged frame casting gated at the bottom through a single gate *A*. The comparatively large stream of metal struck hard against the dry shell core forming the inside of the casting. The result was the inevitable hot spot, formation of dross at *A* and a consequent spongy formation at *B* on the upper flange directly above the gate entrance.

This defect was prevented on subsequent castings by a double gate *R* and *C* at the bottom. Metal from these gates entered the open mold quietly without setting up any commotion.

In addition to the usual hazards incident to the production of any kind of castings, those with pronounced difference in thickness sections present features which at times tax the ingenuity of the molder to the limit. Variable speed in cooling sets up shrinkage and contraction strains. Gates for these castings must be designed with a view of neutralizing these hazards or of reducing them to a minimum.

A general rule, referred to previously in the section dealing with gray iron castings, is to gate the castings as far from the heavier sections as other conditions warrant. In this manner the temperature of the metal in the heavy and light sections is equalized to some extent.

This feature is illustrated in Fig. 209 showing a branch gate at the thin end and a horn gate under the hub. Metal poured through the branch gate will cool perceptibly in the long journey to the hub. Gates on the side as *A B* and *C* would serve the same purpose, but not to the same extent. The horn gate on the hub would defeat its purpose utterly.

This recommended method of gating will not altogether prevent shrinkage in the hub, but it will reduce the total ultimate shrinkage to a considerable extent. The feeding riser used in connection with the end gate, does not need to be as large as the riser required over the hub poured casting.

This is the forty-second of a series of articles dealing with the various types of gates and risers used in the foundry industry. The forty-third will appear in an early issue.—THE EDITORS.

Discusses Cupola at Philadelphia Meeting

B. H. Johnson, R. D. Wood and Co., Philadelphia, addressed the regular meeting of the Philadelphia Foundrymen's association held May 10 at the Manufacturers & Bankers club on "The Balanced Blast Cupola," a recent development of the British Cast Iron Research association, which has attracted considerable interest in Europe. Mr. Johnson recently visited England, where he inspected that type of cupola in operation.

J. B. Greenstreet, president of the association, presided. Announcement was made that the annual election of officers of the group will be held at the June meeting.

Detroit Founders Install New Officers

Detroit Foundrymen's association held its first golf tournament of the season at the Plum Hollow Golf and Country club, Detroit, on Thursday, May 18. A special program was provided for the ladies under the chairmanship of J. D. Stoddard, Detroit Testing Laboratory, Detroit.

Officers of the association, who were elected at the April meeting, and reported in the May issue of THE FOUNDRY, were installed.

Trade Representative

Quandt Chemical Co., 374 Guerrero street, San Francisco, has designated Whitehead Brothers Co., Providence, R. I., as eastern representative for the sale of core oil.

A. T. Wagner Co., Detroit, has been appointed representative of the Steel Blast Abrasive Co., Cleveland, in the Detroit territory. Walter Derlinger, Inc., will represent the company in the Milwaukee district.

French Elect Association Officers

Association Technique de Fonderie, Paris, recently elected the following officers at the annual meeting: President, H. Magdelenat, managing director, Societe des Usines de Rosieres, Bourges (Cher); senior vice-president, J. Lobstein, managing director, Fonderies Lobstein, Colombes (Seine); vice-presidents, A. Brizon managing director Fonderies Brizon Courbeboie (Seine); E. Dady, president Association Amicale et Mutuelle de Fonderie, Paris; J. Derdinger, honorary president, Chambre Syndicale des Fondeurs en Cuivre et Bronze, Paris; Professor F. Girardet, foundry proprietor, Saint-Die (Vosges); Ch. Koehler, managing director, Fonderies de Saint-Ouen (Seine); L. Montupet, managing director, Societe des Fonderies Montupet, Paris; H. Strube, president, Chambre Syndicale des Fondeurs en Cuivre et Bronze, Paris.

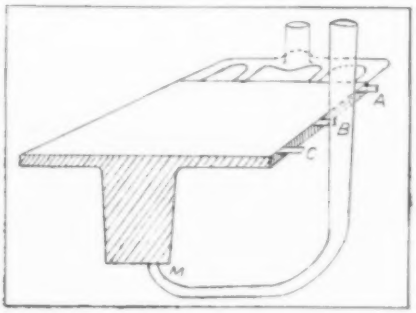


Fig. 209—The horn gate M will intensify the shrinkage feature in the hub. Metal should be poured through the branch gate at the end

Foreign vice-presidents: For Belgium, J. Leonard, president, Association Technique de Fonderie de Belgique; for Spain, J. M. Espana, vice-president, Etablissements Ph. Bonvillain et E. Ronceray, honorary commercial attache for Spain, Choisy-le-Roi (Seine); for Italy F. Jarach, president, National Fascist Federation of Mechanical and Metallurgical Industries, Milan; for Luxemburg, L. Brasseur, engineer, Luxemburg.

General secretary, R. Meyer, director, Societe de Produits Metallurgiques, Paris; treasurer, A. Lardin, director and manager, Societe Lardin et Cie.

Past Presidents Attend May Meeting

Past presidents night featured the regular meeting of the New England Foundrymen's association, held at the Engineers club, Boston, on Wednesday, May 10. Special entertainment was provided by the executive committee of the association during and after the dinner.

"TP" Quality
STARTS IN THE ELECTRIC FURNACE

BUILDING quality into Aloxite "TP" Polishing Grain starts with the electric furnace process—with the Electro-metallurgical miracle of creating an abrasive principally from Bauxite specially selected at the mines—tested, checked and rechecked for quality in our laboratories. Here, under the closest scientific control, Aloxite Brand Aluminum Oxide is made—an extremely tough, hard, sharp abrasive having every quality demanded by the polishing trade.

Visit the CARBORUNDUM EXHIBIT at the FOUNDRY SHOW Chicago

The breaking of the crude pig, the crushing of the lumps to the grain form, the scientific method of washing, cleaning, grading of the grain, the painstaking elimination of plates and splinters—every step in the process carefully, skilfully handled.

Then the treatment of the grain to give it "Surface Tenacity"—a process through which every facet of each sharp, angular grain is roughed or etched so as to give it far greater tenacity or holding power—and you have the ideal polishing grain in

Aloxite Brand "TP" *THE POLISHING GRAIN WITH SURFACE TENACITY*

REG. U. S. PAT. OFF.

[WORKING SAMPLES IN ANY GRIT UPON REQUEST]

THE CARBORUNDUM COMPANY REG. U. S. PAT. OFF. **NIAGARA FALLS, N. Y.**

CANADIAN CARBORUNDUM CO., LTD., NIAGARA FALLS, ONT.

Sales Offices and Warehouses in **New York - Chicago - Boston - Philadelphia - Cleveland - Detroit - Cincinnati - Pittsburgh - Milwaukee - Grand Rapids - Toronto, Ont.**

(CARBORUNDUM AND ALOXITE ARE REGISTERED TRADE MARKS OF THE CARBORUNDUM COMPANY)

Aluminum Removed from Red Brass

Generous applications of barium sulphate and high bath temperature are essential

ALUMINUM can be removed easily from scrap brass by the use of barium sulphate. Foundrymen generally know that barium sulphate as a flux will remove aluminum from copper alloys, but not all foundrymen know how to use it. In removing aluminum from brass, barium sulphate acts as an oxidizing agent and that is all. The aluminum in the brass is converted into oxide of aluminum or alumina. Aluminum once oxidized no longer is a metal, but an earth, or clay in some cases and is not convertible except by the same process used in obtaining the metal in the first place.

Barium sulphate is a chemical compound made up of 1 part of the metal barium, 1 part sulphur and 4 parts oxygen. When the oxygen is removed, the compound becomes barium sulphide, 1 part barium and 1 part sulphur. This is a harmless flux. The sulphur is held too firmly to be separated from the barium by any of the metals in the melt, so it merely mingles with the aluminum oxide, and with any iron oxide contained in the brass as metallic iron. Aluminum and iron go together, so we get rid of the iron as well as the aluminum. The slag is skimmed from the brass and the clean metal is left underneath.

Small Amount Needed

The amount of aluminum in a *white heat* may not exceed 0.20, or 0.30 per cent. Therefore, no great amount of barium sulphate is required to clean the brass. As pointed out previously, when the aluminum is all oxidized, it is gone forever. There is no reversible action. Owing to the trifling cost of barium sulphate, the foundryman can be liberal in its use. If he adds 4 pounds of the sulphate to a 350-pound heat in an electric furnace, his brass will be clean.

High temperature is essential. The brass must be hot for the sulphate to work. That is the only feature more costly than ordinary melting in an electric furnace. A temperature of 2400 degrees Fahr., is required for the reaction between the oxygen of the sulphate and the aluminum in the brass. Many red brass heats are brought up to 2300 degrees Fahr., so it is only necessary to raise the temperature another 100 degrees to insure good, clean metal. The writer has removed aluminum from brass in a crucible hundreds of times, also from metal in oil furnaces and electric furnaces. Probably it could be done in a cupola, although it might not be so easy if there was a considerable amount of aluminum present.

A man knows aluminum is present, but he does not know the quantity. If the quantity does not exceed 0.10 per cent and he adds, say, 1.00 per cent sulphate, he has plenty and to spare. He can figure roughly that it will take three times the amount of aluminum present in the brass, in the shape of barium sulphate, to clean out the aluminum. One ounce of aluminum present will require 3 ounces of sulphate to oxidize it all.

Some of the sulphate may be lost. Some of it may not react with the aluminum. Then, without the slightest doubt, the brass will not be clean. Some of the aluminum is gone, but it is necessary to remove every trace. As the sulphate is very cheap, what's the matter with using a large excess? If there is 1 ounce of aluminum present, 1 pound of flux should be ample.

Of course, no person knows how much aluminum is present in a miscellaneous batch of metal. The foundryman cannot analyze every charge. The barium sulphate will show the approximate amount of aluminum if one wants to take the time to calculate the amount used to remove it. This feature is of minor importance. All the practical foundryman needs to do, is to continue the work of elimination until the aluminum is all gone.

How can one tell when the aluminum is eliminated? When is there not enough aluminum present in the brass to do harm? This point may be determined by the surface appearance. The metal as it cools somewhat on the surface presents a crinkly appearance and the zinc smoke is evolved freely as the skimmer is pushed across the surface. Where aluminum is present, even in small amount, the surface presents a more or less oily appearance; the zinc smoke will not freely evolve. The experienced foundryman instantly can recognize the presence of aluminum.

Where doubt exists—and sometimes it is difficult to tell just when the end point has been reached—a test bar 1 x 1¼ x 6 inches can be poured. The metal is held in the furnace until after the test bar has been cooled in water and examined. Presence of aluminum in the metal will be recognized by fishy patches of a silvery appearance scattered over the surface of the bar. As the metal has been kept hot, one more treatment of sulphate usually will eliminate the remaining aluminum. Addition of about 2 ounces of phosphor-copper per 100 pounds of metal will complete the work.

Assuming that a 10 per cent aluminum bronze has to be cleaned of its aluminum, the bronze in this case will be cleaned to copper. Actual experiment has proved that to be safe 32½ pounds of barium sulphate are required to remove the aluminum from 100 pounds of 10 per cent aluminum bronze, where the metal is brought to a high heat, not under 2400 degrees Fahr. Manifestly, it would not be wise to place the entire 32½ pounds of sulphate on the metal charge as a unit. The sulphate is a heavy mineral, but 32½ pounds is a large quantity of flux. The work has to be done in relays. The resulting alumina is skimmed off after each treatment until all the aluminum has been removed from the metal. The metal in the bath then is copper and can be alloyed to make red brass.

Apply Where Best Suited

The foregoing is an extreme case. It is not usual to remove as much as 10 per cent of aluminum from a bronze mixture. Where the metal is recognized as aluminum bronze it can be used for what it is, rather than waste it by an oxidizing process. For example a 10 per cent aluminum bronze can be made into hardener for making No. 12 aluminum, by melting the bronze and enough aluminum to bring it up to a 50-50 alloy.

Where the amount of aluminum in the metal is unknown, but is assumed to be fairly low—say between

1.00 and 2.00 per cent—it may be treated first with a few pounds of barium sulphate. If the aluminum still persists and can be detected readily after the metal has been stirred and skimmed, it must be processed again and if necessary again until the metal is cleaned of all aluminum. The cost of the flux is low. The work is not strenuous and the results are positive where the operator uses ordinary common sense. There is nothing magical in the process. It is a chemical reaction requiring heat and oxygen. The aluminum is removed positively and cheaply. The resulting brass is renewed and is just as good as if made from new metals.

Every time the sulphate is used, some of the aluminum is removed. There is less in the metal than when the process was started. True it may not all be gone. The observer cannot tell how much is left in the brass, or how much was taken out, for it shows up much the same in all cases until the end is reached, where no more aluminum remains. After the aluminum is removed, the brass can be used for valves, fittings or anything else. It is better metal for having had the aluminum in it. The aluminum has thoroughly deoxidized the metal.

Aluminum does not depreciate brass. One might think that because aluminum had been oxidized in the brass, some of it had remained there and injured the metal. However, attention is directed to the fact that a generous excess of sulphate is used. Enough of this is turned to sulphide to provide oxygen to take all the aluminum. The aluminum oxide is held firmly by the fluxes formed, with the result that the brass is cleaned thoroughly when the debris is skimmed off.

This method of refining brass is based on the action of the aluminum, once a part of the alloy and then removed. The removal takes out all the iron and most other impurities. Large castings, perfect in every particular, have been made from this purified metal, reclaimed directly from emery grindings, dirty borings and *irony* residues of all kinds. Tin or zinc will not be oxidized by the barium sulphate.

Even if no aluminum is present in brass, a flux of barium sulphate can do no harm. Good practice favors the use of this material under any circumstance. Some aluminum may be present in the metal, since it is so widely distributed in scrap brass. Experience has shown that where lead is present in considerable amount in the alloy, for example in many bearing metals, a flux of barium sulphate closes the grain of the metal and therefore greatly improves the bearing quality.

Success of the process depends on aluminum, barium sulphate and heat. Unless the metal containing the aluminum is hot, the reaction will not take place. The melter superheats the brass, adds the sulphate, gives it time to get heated; then to further the reaction, uses the poker and rubs the sulphate against the side of the pot. This sets off the reaction. The sulphate becomes incandescent and the brass is stirred.

Barium sulphate will not oxidize the zinc in a mixture except to the extent of burning some of it out. Only a trifling amount is lost in this manner. It is necessary to get the copper-zinc alloy to the flaring point to take out the aluminum. When the aluminum is all oxidized, which can be noted by the absence of the oily appearance of the metal and by the increased flare, then is the time to cool down the metal. The absence of aluminum then can be noted readily. The metal then is yellow brass and it may be used as yellow brass. So long as it contains aluminum it is not fit for use in yellow brass. Therefore every bit of aluminum will have to be removed from the brass before it can be used to advantage in making other alloys.

It is not at all difficult to learn how to remove aluminum from nonferrous mixtures. It may be necessary to re-treat the metal again and again, according to the amount of aluminum present. A test bar will show up as yellow brass if no aluminum is present, but will look like manganese bronze if aluminum still is present in the metal.

New Equipment To Feature Show

(*Concluded from Page* 33)

type, quick anneal oven for malleable foundries, which, it is said, reduces the annealing time of castings 50 per cent without detracting from the quality of the product. A motion picture will show the oven in detail and will illustrate the complete cycle of operations. A new recuperator for application to malleable iron air furnaces likewise will be shown.

A new compound for making match plates, mounting metal gates and large wooden patterns, or making duplicate match plates has attracted considerable interest among a number of foundrymen who have experimented with the material, and will be shown at Chicago. One company will display a new core oil made from soy bean and other vegetable oils, while another company will show cores produced with a completely new line of oils developed during the past few years. Several new types of foundry flasks, aluminum slip flasks and jackets will be on display. One all steel flask to be shown is galvanized after fabrication and has removable stainless steel bushings and pins.

Chaplets of various types will be shown and one firm will display a new babbitt anchor, a tin form for casting shaker lugs on grate bars, cover lips used for holding porcelain plates in stove doors, hinge tubes with the tube locked in place to prevent turning, etc. New developments in pyrometers will include a wall type for nonferrous metals, a unit for measuring surface temperatures up to 800 degrees Fahr., a unit for measuring rapid temperature changes, and a special foundry type pyrometer which has a direct heat reading scale and in addition to its regular calibration, has an additional scale giving the temperatures of molten iron and steel when measured in the open. Numerous items of safety equipment will be shown including several types of new helmets and masks.

Many foundrymen, who will be in Chicago for the convention and exhibition, are familiar with the type of show held in the Exhibition hall of the Stevens hotel, through attendance in 1929 and 1931 displays in the same location. While it is possible to operate only the smaller units, the fact that many machines will be on display and that experts will be on hand to provide complete information on operations, makes it possible for the exhibition visitor to balance the possibilities of the various types of machines to his particular problems.

A. F. A. Meeting Offers Opportunities

(*Concluded from Page* 32)

City Foundries Co., Cleveland will speak on "The Field of Materials Handling in a Semiproduction Foundry."

A conference on apprentice training is scheduled for Friday noon, and during the afternoon members of the industry and representatives from colleges and universities will hold a conference on foundry education in engineering schools.

Introduces Alloy

Duriron Co., Dayton, O., has developed a new alloy, named durichlor, which is claimed to be almost entirely resistant to hydrochloric acid at all concentrations and all temperatures up to the boiling point. The metal is being used in pumps, valves, pipes, fittings, jets and other chemical equipment.

There is Profit for you in the Experience of these men!

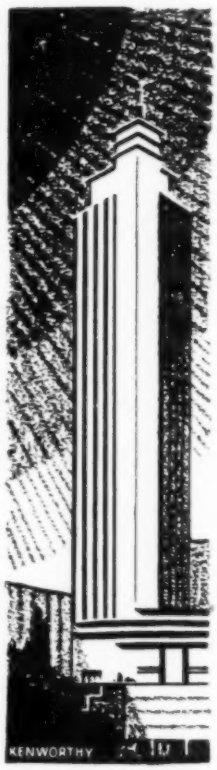
Never before has the experience of successful sales promotion executives meant so much! Never before have the lessons to be learned been so valuable!

The minds that the N.I.A.A. has gathered together for the coming "Industrial Marketing Conference" in connection with Engineers' Week and A Century of Progress have a message of help for YOU. They have a story of proven sales and advertising success during the tragic years of 1931 and 1932.

Look over these names and plan to hear these men!

W. L. Rickard, Pres., Rickard & Co.
A. C. Nielsen, Pres., A. C. Nielsen Co.
Bennett Chapple, Vice-Pres., American Rolling Mills Co.
Donald R. Dohner, Dir. Art, Eng. Dept., Westinghouse Elec. Co.
L. S. Hamaker, Sales Promotion Mgr., Republic Steel Corp.

These are but a few of the many that will discuss advertising, sales promotion, marketing methods and their relation to existing conditions and the future of selling. These men know their subject and have solutions to problems similar to yours. To hear them is to profit!



TIE THESE TOGETHER IN ONE BIG WEEK—

National Industrial Advertisers Association Industrial Marketing Conference
Engineering Week
Midwest Power Show
A Century of Progress
Chicago, the Summer Resort

JUNE 26-28

—And your Special Problems will get Special Attention!

Clinic talks will discuss actual campaigns, reasons why, and objectives desired. There will be booths where subjects dealing with sales presentation, the planning and making of sales manuals, the problem of the house organ, the obtaining and selling of construction leads, translating inquiries into sales, etc., may be discussed at leisure with those that have been studying these subjects for weeks, and are fitted to be a real help to you. An advertising exhibit will treat the campaigns that have run during the year. There you can see what your competitor is doing in its entirety.

Plan now to come! See the Fair—visit the many conventions during Engineering Week—stay for the Midwest Power Show and live at the beautiful Medinah Athletic Club with all its pleasant facilities.

We are in a position to make arrangements to ease your stay for the Fair. Let us help you.

June 26 to 28! We expect you! Write for details.

NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION

National Headquarters — 537 S. Dearborn St.
CHICAGO

Fire Clay for Follow Boards

(*Concluded from Page* 35)

clay follow board 12 x 16 inches is made up of 2 x 2-inch wood strips fastened to a wood bottom board. Metal might be substituted for wood, but since some of these follow boards have been in existence for many years, it would seem that wood is sufficiently durable. Flask guides at each end of the frame are adjustable to compensate for any slight expansion or contraction of the frame under varying conditions of moisture and temperature.

So long as the follow boards are in daily active service no adjustment is necessary. However, occasionally a follow board may be retired to storage for a considerable period. Here the moisture evaporates from both clay and wood and naturally a little adjustment may be required in the guides when the follow board first is returned to active service.

In this respect, indefinite life and usefulness, even though subjected to the usually wrecking influence of intermittent operation, the fire clay follow board seems to present an advantage. As with the desert which under the influence of irrigation blossoms like the rose, so the neglected clay bottom board, disreputable and disfigured by large, gaping cracks, once more assumes its smooth, sleek surface when treated to a bath. The clay absorbs the water at any stage of its existence and becomes as plastic and workable as when first pressed into service.

This feature, retention of plasticity over an indefinite period, is taken advantage of in another way. Thus when a pattern becomes obsolete, or is taken out of production for any other reason, the follow board is not thrown away or destroyed. On the contrary, the clay is moistened and re-worked to fit another pattern.

Occasionally orders for different castings overlap to such an extent that it becomes necessary to group two or more varieties of patterns on one follow board. An instance of this is shown in Fig. 1 where a gate of snap patterns has been replaced by a gate of buckle patterns.

A change of this kind may be accomplished in an hour. No delay is experienced waiting for the clay to dry and harden. The instant the follow board leaves the patternmaker's hands it is in condition for the molder to use. The clay is neither hard nor soft, but rather firm and resilient, the ideal condition to meet the pressure of the sand forced against it under the head of a pneumatic molding machine. The drag part of the mold is squeezed on the follow board and the cope part of the mold is squeezed against the drag. The two parts are separated by only a thin film of parting compound. In the majority of instances a sharp eye is required to discern any trace of a parting line on the castings.

The method of preparing one of these clay follow boards corresponds almost exactly to the method pursued by a molder in bedding a pattern in the sand either in a flask or in the floor. The clay first is prepared by the addition of a little water and a still smaller quantity of oil, ordinary crude oil. The amount of water is just sufficient to render the clay workable which means that it is damp, but not wet. The oil removes the stickiness to some extent and also retards the evaporation of the water. Thus if the face of the follow board is sprayed with water occasionally, rubbed with a damp sponge, and covered with a damp cloth when not in use, it will present a perfect working surface indefinitely.

The frame is filled with clay, pounded into place with a mallet and then scraped off flush with the contact face of the frame. The gate of patterns is placed temporarily on the flat surface and adjusted to show an approximately equal margin at the sides and ends. The outline is scribed on the clay and the pattern is removed. The patternmaker removes a sufficient amount of clay to correspond approximately to one-half the bulk of the pattern. He loosens up the clay in the bottom of the excavation and then places the oiled pattern in position. With the aid of a block of wood and a mallet he raps the pattern down into soft clay as shown in Fig. 3. The distance the pattern is rapped down depends on the parting line. Where a pattern is symmetrical, as in Fig. 2, it is rapped down to a point where a straight edge resting on the ends or sides of the follow board frame will coincide with the center line of the pattern.

After the patternmaker has satisfied himself that the pattern is located properly in regard to the proposed parting line, he rams clay under and around it precisely after the manner of a molder ramming sand around a pattern under similar circumstances. He then removes the surplus clay, sleeks the surface flat wherever possible, and sleeks the remainder smooth along the parting line of the pattern or patterns.

Patterns in the first stage before the clay has been tucked around them are shown in Fig. 2. A second group of smaller patterns in which the surface has been finished at the right end but still is in an unfinished state over the remainder, is shown in Fig. 4. Examples of finished follow boards with the patterns in place are shown in Figs. 1, 5 and 6.

Fig. 7 illustrates a snap flask drag rammed on one of the clay follow boards. It is introduced here to illustrate the method employed for molding swivels in which the anchor in one link revolves freely inside a suitable projection on a second link. As a matter of fact, these devices are the result of two, and not of a single casting operation. The links, eyes or hooks forming an extension of the swivel bar are cast first. After a thorough cleaning the neck of the bar is dipped in core oil and then coated with a thin film of fine sand. After the coating has been dried thoroughly in an oven the prepared castings are placed in a second mold provided with cavities for their reception in proper relation to the mold cavities for the remaining part of the swivel ensemble. In the illustration the little castings may be noted in place on the outside of the group of molds near the ends of the flask and on the inside of the two groups of molds near the center.

Discusses Quenching And Tempering of Alloys

The annual May lecture of the British Institute of Metals was given in London on May 10, with Sir Henry Fowler in the chair. The paper, entitled "The Phenomena of Quenching and Tempering in Alloys," was delivered by Professor Albert Portevin, immediate past-president of Societe des Ingenieurs Civils de France, and member of the Institute.

Professor Portevin, whose investigations in metallurgy are widely known, gave a comprehensive discourse on the subject of quenching and tempering in alloys generally, and pointed out that whereas not many years ago these phenomena were only considered in relation to steel, and when they occurred in other alloys, these were often considered as exceptional. Present-day knowledge shows that the phenomena of quenching and tempering are of quite a general nature and apply to a very considerable number of alloys and that the peculiar way in which steel answers to these heat-treatments tends to show that it is steel which now is the exception.

Strength Is Higher

Tensile strength of the iron, a section of which was reproduced as a micrograph in Fig. 3, page 19 of the May issue of THE FOUNDRY in connection with the article "Test Shows Cupola Melting Loss" by M. J. Gregory, was 39,300 pounds per square inch instead of 27,000 pounds as stated in the caption. THE FOUNDRY regrets this typographical error.

Estimating Blue Print Weights

(*Concluded from Page 37*)

webs or connecting members between the two ends, may be figured according to the formula $(A + B)\ \frac{1}{2}\ H$ x the thickness as indicated in Fig. 2. In this instance $A = 1$ inch, $B = 1\frac{1}{2}$ inches, $H = 1\frac{3}{8}$ inches and the thickness is ¼-inch. Therefore the cubical content will be secured by substituting in the formula, as follows: $(1.00 + 1.50) \times 0.50 \times 1.375 \times 0.25 = 0.430$ cubic inch.

Must Be Deducted

Section *D*, is included in the contents of section *E*, therefore it must be deducted from section *D*. The cubical content of a cylinder ½-inch in diameter and 9/32-inch in length is as follows: $0.50^2 \times 0.785 \times 0.2813 = 0.055$ cubic inch.

Section *E* is a hollow cylinder ½-inch in diameter, ⅞-inch in length with a central cored hole ¼-inch in diameter. The cubical content of a cylinder equals $D^2 \times 0.785 \times$ the length. The process in the present instance may be shortened by deducting the square of the inside from the square of the outside diameter. The difference between 0.50^2 and $0.25^2 = 0.1875$. Therefore the content of *E* is $0.1875 \times 0.785 \times 0.875 = 0.129$ cubic inch.

Sections F_1 and F_2 constitute the second web or cross member uniting the two ends of the casting. This section is divided in the center by the cylinder *E*, hence the necessity of estimating separately the content of the two units F_1 and F_2. Section F_1 7/16-inch wide and ¼-inch thick, measures 1¼-inch along one side and 31/32-inch along the other side, that is along the side of the cylinder *E*. The intersecting web *D* cuts 9/32-inch from each side since *D* already has been estimated as a continuous member. The length 1⅛—9/32-inch becomes 0.8437 and the length 31/32 — 9/32 becomes 0.6875. Result of adding these two lengths and dividing by 2 is 0.7656. Formula for section F_1 then apears as $0.7656 \times 0.4375 \times 0.25 = 0.083$ cubic inch.

The same procedure is followed in section F_2 where 9/32-inch is deducted from the two sides which are 25/32 and ⅝-inch respectively in length. The result divided by 2 (or multiplied by ½) is 0.4215. Therefore the cubical content of F_2 is $0.4215 \times 0.4375 \times 0.25 = 0.046$ cubic inch.

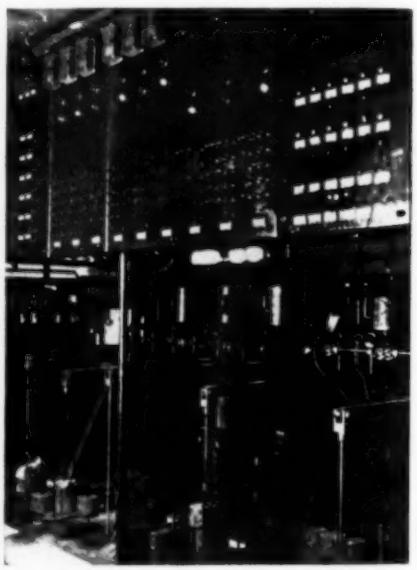
Set down in tabular for the result of the various calculations may be grasped more readily:

A — 1.75 × 1.125 × 0.4375		0.862
B — $S = 0.75^2 \times 196^2 \times 0.00873 \times 0.4375$	0.422	
Less 0.50 × 1.125 × 0.4375	0.246	0.176
C — 0.625 × 1.00 × 0.25		0.156
D — 1.375 × 1.25 × 0.25	0.430	
D_1 — Less $0.50^2 \times 0.785 \times 0.2813$	0.055	0.375
E — 0.1875 × 0.785 × 0.875		0.129
F_1 — 0.7656 × 0.4375 × 0.25		0.083
F_2 — 0.4215 × 0.4375 × 0.25		0.046
Total cubic inches		1.827
Weight cubic inch cast iron		0.26
Estimated weight of casting		0.4750
Plus 10 per cent, fillets, draft etc.		0.0475
Final estimated weight		0.52 pound

Measures Creep With Extreme Accuracy

When hot, metals slowly yield under a steady pull, like taffy or cold tar, so P. G. McVetty of the Westinghouse Research Laboratory, patiently investigates this *creep* at high temperature. Automatically held at exact temperatures in individual furnaces various samples carry heavy loads for months, while sensitive instruments indicate changes of a millionth of an inch. Curves are plotted and the alloys best suited for the purpose are then selected.

Today steam turbines attain peripheral speeds at the blade tips of 15 miles a minute and operate at a temperature of over 800 degrees Fahr. Testing for creep of steam turbine materials represents the highest order of sensitivity and accuracy.



Apparatus which measures creep at high temperatures

To measure creep rates of this order of magnitude requires not only the measurement of extremely small length changes, but, precise measurement and control of temperatures.

While the creep test is the best known means of predicting the value of a material for high temperature service involving small permissible deformations, its limitations must not be ignored. At best, the length of a creep test is small compared to the time during which a material is expected to give satisfactory service. Extrapolation of creep curves is necessary but great care is essential if large errors are to be avoided.

Book Review

The Abolition of Unemployment, by Frank D. Graham, cloth, 99 pages, 5½ x 9, published by the Princeton University Press, and supplied by THE FOUNDRY, Cleveland, for $2, and in Europe by the Penton Publishing Co., Ltd., Caxton House, Westminster, London.

A plan for alleviating unemployment and turning the tide of the depression has been discussed in considerable detail in this volume. The plan proposes the establishing of a national Emergency Employment Corp. to arrange for the employment of all willing and at present involuntarily idle workers at jobs for which they are equipped. These workers would be paid according to their own choice, in goods they themselves make.

The corporation would make contracts with existing producers who would carry on all processes of production. The producer would receive a rental for the use of the plant and equipment and a return for managerial services. The product would be distributed through agencies either established or under the control of the corporation. Wage payments would be made in certificates, the value of these certificates being established through a tabulation of the week's production. The worker would purchase the goods at the distributing agencies at prices the same as identical goods in the ordinary marts.

The author discusses the various factors which should be given consideration in setting up the plan, points to the objections which might be raised and presents arguments to refute these objections.

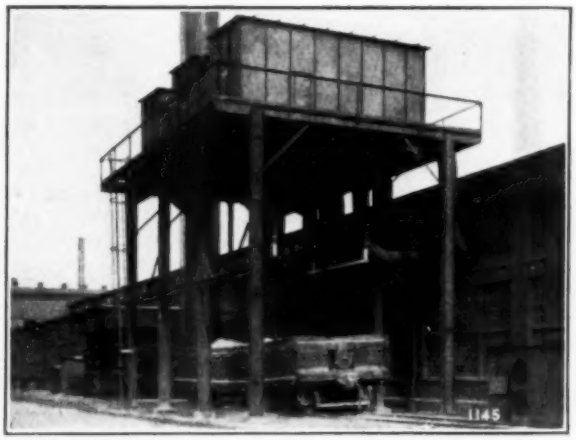
Heads Hoist Group

Donald B. Patterson, vice president, Harnischfeger Corp., Milwaukee, recently was elected chairman of the Electric Hoist Manufacturers' association. Frank F. Seamen, Robbins & Myers Sales Inc., Springfield, O., was elected vice chairman.

In Your Cleaning Room Use

SLY IMPROVED EQUIPMENT

Many improvements have been made in the last two years. Get the benefit from these improvements, at lower prices for the improved equipment. Ask for details.



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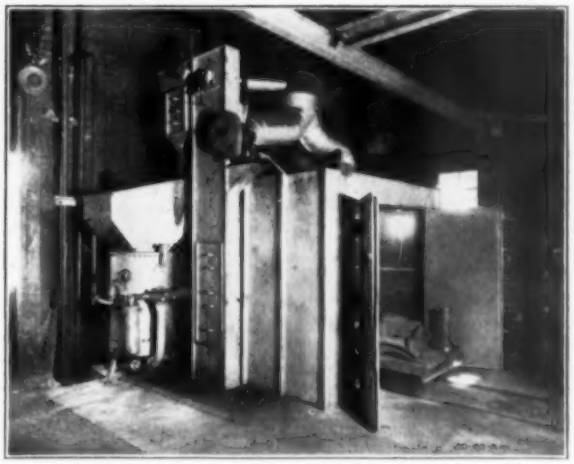

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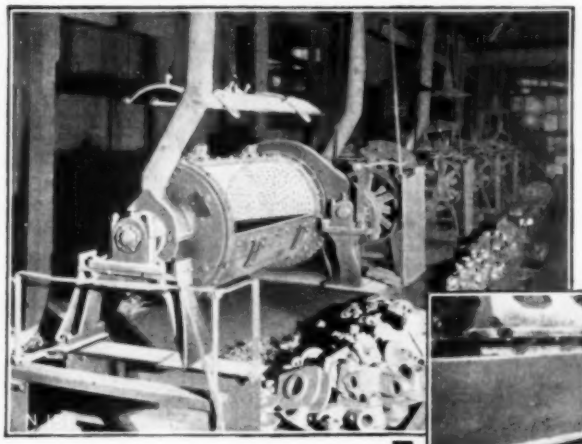

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Makes Castings in Metal Molds

(*Continued from Page 39*)

ry. The generator is a 300 pound duplex type made by the Oxweld Co., New York, with a capacity of 1000 cubic feet of acetylene gas per hour. Calcium carbide from which the gas is manufactured is kept in a separate compartment in the generator building.

The circular machines supporting the refractory lined molds are automatic in operation, and the cycle comprises five operations, namely blowing out and smoking the mold after the casting has been removed; closing the mold; pouring; cooling, and opening the mold for removal of the casting. Each of the operations occurs at a definite place as the table rotates. Pouring takes place under an overhead tramrail supporting the ladle, and the mold is opened almost directly opposite; the molds rotating in a clockwise direction.

Smoked Under Hood

Blowing out the open molds and smoking them takes place under the hood shown in Fig. 4, which is about 3 feet to the left of where the castings are removed. After passing under the hood, the molds remain open for a short distance enabling an operator to set cores. Then they are closed automatically, as they move to the pouring station. In terms of one revolution of a mold, it is closed for about one-fourth of the time and open for three-fourths during which time the casting is removed, the mold blown out and smoked.

Molds for the machines are cast in dry sand. Long experience has dictated that method as the resulting castings can be made with such accuracy that only a minimum of machining or grinding is required before they are placed in service. While considerable experimental work has been performed from time to time on various types of irons to determine their suitability for mold material, it has been found that the most economical material is the same metal as is used in making the castings produced in the molds. That gray iron contains about 2.60 per cent silicon and about 3.50 per cent total carbon.

Sizes of the molds will vary to some extent depending upon the type of casting to be produced, and the type of casting machine it is to be used in. Molds for the rotary casting machines are uniform in size to permit interchangeability. Hand operated machines, due to the simple open and closing mechanism employed, easily may be constructed to operate molds of various sizes. However, as in the case of the automatic rotary machines, molds of the same size are used on any one hand operated machine, and are usually made to fit the automatic machines as well.

Molds for the rotary machines are about 18 x 20 inches, and as shown in Fig. 5 are similar in form to a box open on one side. The metal thickness is about 2 inches at the joint faces, and of course, is considerably thinner at the deepest portions of the mold cavities. The number of castings made in a mold will vary with the size, and may be from one, as in the case of a camshaft, to 16 in the case of the valve guide bushings shown in Fig. 2, or 12 for the small pump pistons shown in Fig. 6.

Rate of casting production on the rotary machines will vary according to the size of the castings being made. With heavier castings the speed of rotation has to be reduced to allow sufficient time for the castings to solidify before the molds are opened, and to permit the molds to cool down to the operating range before the metal again is poured into the mold. An average rate of production is said to be about 15 tons of castings per machine per 10 hours.

Mold temperature during operation is important, but not difficult to maintain as a fairly wide range is permissible on the usual run of castings. That range is from 600 to 900 degrees Fahr. However, in some cases it is necessary to hold the temperature closely in control, as for example in castings where a chill is desired. In that case the mold must not become too cold and permit cold shuts or misruns to occur, nor can the mold become too hot, and reduce or eliminate entirely the chill.

Metal for the permanent mold machines, of which there are eight of the rotary type, and a number of the hand operated type, is obtained from one of two cupolas lined to 32 and 36 inches respectively. The cupolas are located on one side of the building, and centrally with respect to the machines which are in a long row. The cupola room is between the core room and the machine shop and separated from them by brick walls. It opens into the permanent mold department as shown in Fig. 3, forming a T-arrangement with the cupolas as the base of the T and the permanent mold machines as the arms.

As may be observed in Fig. 3, molten metal from the cupolas is transported in 800-pound ladles suspended from an overhead tramrail system extending along the row of machines. From the bull ladles, the metal is transferred into small hand shanks also suspended from overhead rails, and poured into the molds as they rotate in front of the pouring station.

Metal charges for the castings are composed of pig iron foundry returns and purchased scrap. The pig iron charged ranges from 2.75 to 3.00 per cent in silicon, 0.30 to 0.35 per cent in phosphorus, and 0.60 to 0.70 per cent in manganese. While, as previously mentioned, the silicon content of the resulting castings is about 2.60 per cent and the total carbon content about 3.50 per cent there is considerable improvement in the tensile strength and structure of the metal poured in permanent molds. It is not unusual for permanent mold iron to show 30,000 to 35,000 pounds per square inch tensile strength with a dense, fine grained structure, possessing toughness and resiliency.

Remove Castings from Mold

As the molds come around to the point shown in Fig. 2, they open automatically, and an operator standing on a raised platform hooks the gate of castings from the mold. Usually there is a small interval of time in which the casting stays in the mold cavity before dropping out of its own accord, and it is during that interval that the casting is hooked out. The operator then throws the gate of castings into a lift truck tray. In the case of the heavier castings where it is easier to remove the gates and risers, they are broken off and the castings placed in separate trays. With the lighter castings where a large number are attached to a gate, as shown in Fig. 2, it has been found best to let them break off in the tumblers.

All castings produced by the Eaton-Erb Foundry Co. undergo a heat treatment which not only relieves any possible casting strains, but also improves machinability, and enhances the physical properties through proper selection of the temperature at which they are exposed, and the length of time through which they are subjected to that temperature. The temperatures employed range from 1500 to 1600 degrees Fahr., and the length of time from 15 to 25 minutes. The lower temperatures and longer time are used with sand castings, and the higher temperature and shorter time with metal mold castings.

The furnace used for heat treatment is a tunnel type, pusher furnace, oil-fired. Six burners, three on a side are located about 15 feet from the entrance of the furnace which has an overall length of 44 feet. The first 10 feet approximately of the furnace constitutes the preliminary heating zone while the next 5 feet comprises the high temperature zone. The remaining portion of the furnace is the cooling zone. Burners are located so that the heat is thrown toward the furnace entrance which

(*Concluded on Page 76*)

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(*Concluded from Page 74*)

hastens the preliminary heating or raising to temperature of the castings, and aids in keeping the rear of the furnace cooler. Temperature of the furnace is controlled automatically within 5 degrees of the desired point. The total time occupied for heat treatment from the time the castings enter the furnace until they come out at the opposite end is approximately 2½ hours.

Castings are carried through the furnace in heat resisting cast iron trays about 6 x 10 x 42 inches, and care is observed to place about the same weight of castings in each tray so that with small variations the quantity of heat required to raise the castings to the desired temperature is the same whether large or small castings are being heat treated. As near as is practicable only castings of the same size and shape are placed in one tray.

When the castings have cooled down to handling temperature, they are dumped into steel tote boxes or barrels and taken to the cleaning department where they are sandblasted in rotary units made by the W. W. Sly Co., Cleveland. After sandblasting, the castings are taken to the snagging room where the small projections left after removing the gates and risers are ground off. Then the castings are sent to the inspection benches, except in some instances other grinding operations of a precision nature are performed before the castings are inspected.

One casting that is handled in that manner is a valve guide bushing which is a small casting about 2¾ inches long and ⅝-inch in diameter with a slight taper at one end. That casting is precision ground for length in a special double spindle disk grinder designed by engineers of the Eaton-Erb Co., and then rough ground on centerless grinding machines for diameter. Both length and diameter are held within plus or minus 0.002-inch tolerance, thereby allowing the machine shop to handle them with the same precision they would handle cold rolled bar stock.

The Foundry Views the 1893 Fair

(*Concluded from Page 27*)

ness!" An example of editorial impartiality, equal readiness to bestow praise or blame where deserved, appears in a paragraph in Sept. 1893 issue:

The quarreling and squabbling that have made the various commissioners in charge of the Columbian Exhibition famous, keep up without missing a stroke or slipping a cog (1893 equivalent for hitting on all sixteen). However, the board of lady managers so far, seem to be carrying off all the honors, judging from the press reports of some of their hysterical sessions.

In one of the galleries of the Mining Building the editor's professional eye was caught and held by a small cast iron pot from Lynn, Mass., one of the first iron castings made on this side of the Atlantic. The same building also contained a remarkable exhibition of light, ornamental castings made in Russia, many of which now are permanently preserved in the offices of THE FOUNDRY in Cleveland.

In the Manufacturers Building he saw a somewhat similar but more elaborate display of castings, both iron and bronze, made in France. Winslow Bros., Chicago had a magnificent display of ornamental cast and wrought iron and bronze metal work. R. D. Wood & Co., had a length of 72-inch diameter cast iron pipe, considered to be a remarkable piece of work and the largest size of pipe made at that time. The molding machine industry was represented by a power squeezer in operation, made by the Tabor Mfg. Co., Philadelphia. Instead of hydraulic or compressed air power the machine was operated by steam. An electric traveling crane in the machine shop was considered sufficient of a novelty to warrant a full page story and illustration. Particular attention was directed to the fact that the crane had a lifting capacity of 14 tons and that the hoist, the rack and the bridge movement were controlled by individual motors.

Exhibit of the Michigan Stove Co., Detroit was housed under an immense wood model of a kitchen range. The space under the stove was sufficient to accommodate samples of the line of stoves made by the firm, desks for the salesmen and lounging space for visitors. An added attraction was an ancient stove made in France, brought out to America in 1693 and set up in the first convent in Quebec. It was the property of Chas. F. Guenther, Chicago and was valued at $10,000.00

Plan Institute Conference at Cardiff

The thirtieth annual conference of the Institute of British Foundrymen will be held June 20 to 23 at Cardiff, South Wales. The following papers will be presented at the meeting: "Mechanised Foundries," by F. J. Cook; "Routine Methods for Testing Green Sands," by the sands subcommittee of the technical committee; "Alloy Grey Irons," by Dr. Ing. C. W. Pfannenschmidt; "Heat-Resisting Cast-Irons," by E. Morgan; "Alloy Cast-Iron" by Frank Coyle (American exchange paper); "Anodic Treatment and Dyeing of Aluminum Castings," by N. D. Pullen; "Coking Practice in the South Wales District," by W. R. D. Jones.

During the meeting, visits will be paid to the works of The British (Guest Keen Baldwin) Iron & Steel Co. Ltd., John Williams & Sons (Cardiff), Ltd., Brown Lenox & Co. Ltd., manufacturers of steel castings and chains, Powell Duffryn Steam Coal Co. Ltd., the tobacco works of W. D. & H. O. Wills Ltd., and the Bristol Aerodrome.

Offers Prizes For Ideas on Cast Iron

Each year the *Centre de Recherches de Fonderie*, the French organization set up for researches in foundry problems, holds a competition and gives prizes for the best inventions susceptible to contribute to the development of the use of cast-iron. For the year 1933, papers will be accepted up to Nov. 30, and a prize of 10,000 francs is available for the best paper received. This prize can be divided if the jury considers it advisable to do so, or it can be withheld in whole or in part for the competition taking place the following year if the jury estimates that none of the papers presented merits a prize.

In the year 1932, the prize of 10,000 francs was not allocated, but one prize of 2000 francs was awarded to Messrs. Herry and Mettauer for their paper on "The Utilization of Cast-Iron for the Manufacture of Tiles and Other Castings Used in Covering Buildings," and a prize of 1000 francs was awarded to M. Simorre for his paper on "Metallic Pavements and Roads With a Covering."

Speaks on Sand

Walter M. Saunders, Providence, R. I., addressed the regular meeting of the Connecticut Nonferrous Foundrymen's association held May 8 at the Hotel Garde, New Haven, Conn., on the subject of "Foundry Sands." C. H. Blanchard, Reading, Pratt & Cady Co., Hartford, Conn., presided. The next meeting of the group will be held in October.

Blaisdell-Folz Equipment Co., 219 West Pearl street, Cincinnati, has been appointed representative of the Chain Belt Co., Milwaukee, for the latter's line of construction equipment.

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Profits Through Classified Costs

(*Concluded from Page 40*)

is lower, and indirect labor is high due to greater floor space and machine equipment. In the heavy floor department there is usually an expensive crane, with added charges for depreciation, repairs, power, and cranemen. Cleaning up labor is higher, for work must be shaken out and moved with the crane, heavy iron flasks and bottom plates must be moved in and out from the yard and flask expense is heavier than for snaps. There is perhaps some oven expense for dry sand work, and if pouring is done by a separate pouring gang, that also goes into overhead. Direct labor is fairly low.

Charges Are Heavier

In the jolt roll over (or other heavy machine) department there are heavy charges for depreciation, repairs, and power for both crane and expensive molding machine equipment, also for cranemen. Where wood flasks are used, there is often a heavy charge from the carpenter shop. Direct labor cost often is cut in half, which naturally increases overhead in proportion. Only a few of the items which cause the variation in overheads in the various molding departments, have been mentioned, but they are enough to show that these variations are natural and to be expected.

An error in molding overhead is particularly serious because this is usually one of the largest items in cost. It is, of course, most serious on the more expensive jobs. Take, for example, jobs which have a direct labor cost of 2 cents per pound and see what the error would be in each department from using one flat overhead in a shop whose overheads are as follows: jolt—175 per cent; heavy floor—150 per cent; light floor—120 per cent; squeezer—100 per cent; bench—80 per cent. Average flat overhead for all departments—110 per cent.

	Jolt Job 175%	Hvy. Fl. Job 150%	Lt. Fl. Job 120%	Sqzer. Job 100%	Bench Job 80%
Molding overhead at correct rate	3.5	3.0	2.4	2.0	1.6
Molding overhead at flat rate—110%	2.2	2.2	2.2	2.2	2.2
Error	1.3	.8	.2	.2	.6

If this shop used one flat molding overhead percentage on all jobs, it is evident that the error on many jobs would be serious. Their cost on heavy floor and jolt jobs would figure much too low, and on bench jobs it would be much too high. As a result they would take in floor and jolt work at prices which they thought were profitable, but which were really below cost, and they would be likely to lose money in their heavy floor and jolt departments without knowing it. This is a condition which occurs frequently in shops which run both light and heavy work. A condition like this tends to get more and more serious, for since the prices quoted on heavy floor and jolt work are too low, these unprofitable departments tend to fill up more than the profitable departments, with the result that the proportion of losing work in the shop steadily increases.

The error from using one flat molding overhead percentage is, of course, less serious in shops which handle heavy work only, or light work only. But there are a great many foundries who handle both. Before assuming that the error would not be serious in your shop it would be better to take the trouble to find out exactly how much profit or loss each molding division actually is producing. This is a comparatively simple matter after molding subdivisions have been set up, and a report of this kind would be an eye opener to many foundries. The merchandising policy of some foundrymen is based solely on hunches, guesswork, or personal preferences. They think there is "more money in heavy work," or they have a pet jolt department that they like to show to visitors. But they have never seen any actual figures for the profits produced by each department. When these figures are put before them for the first time, with the overheads adjusted to the correct figures, they are amazed to find that the heavy floor department is losing money, because unknowingly they have been taking work below cost, or their pet jolt department is merely breaking even, because the high overhead and perhaps higher percentage of scrap, has neutralized entirely the gain from higher production. If in the habit of taking a great deal of work at flat prices, throwing in the small bench work at the same flat price set on a few heavy jobs, they may be shocked to find that the loss on the small tonnage produced by their bench department is almost as great as the profit on the much larger tonnage produced by the heavy floor department.

Hunches and guesswork do not provide a safe guide in establishing merchandising policies. Actual experience in many foundries where the *Standard Cost System* has been installed has proved this conclusively. The only safe basis for determining what class of work should be solicited most aggressively is an accurate profit analysis by jobs, accounts, and molding departments. When you find that any department is making a poor showing naturally you will try to remedy that condition either by cutting costs or raising prices. If over a period of time, in spite of best efforts to improve it, the floor department continues to show up badly, and the squeezer department always shows a fair profit, this is conclusive evidence that squeezer work happens to be more profitable in that particular shop and market, and this evidence must be accepted even though it runs counter to previous ideas or personal preferences. Perhaps competition on heavy work is too keen to enable handling that class of work at a profit, or perhaps the foreman is more capable on light work than on heavy work.

Lowers the Price Level

The example used may give the impression that the author has a personal preference for light work. To a certain extent this is true, for it has been my experience that in most districts there are one or two foundries who do not put enough overhead on heavy work, and who therefore spoil the price level on this class of work for everyone else. But conditions are different in every district, and in many markets heavy work may be more profitable than light. In any case, profit analysis by molding departments is the only safe guide in establishing merchandising policies.

Another reason for carrying classified molding costs is to be able to compare costs with other foundries. Many local cost groups have been organized during the last 10 years, and have proved most valuable in reducing price cutting, enabling members to effect substantial reductions in cost by the aid of cost comparisons. When comparing molding costs it is absolutely necessary that they should be classified into heavy floor, light floor, squeezer, bench, and jolt, to be able to draw reliable conclusions from them. If the comparison shows only average molding direct labor and average molding overhead, it is of little value. A comparison of average molding costs of a shop running 80 per cent squeezer work with another shop running 80 per cent heavy floor work would give no information which would be a dependable guide for action. Squeezer costs must be compared only with squeezer costs, heavy floor with heavy floor, etc. to get information which will be of any practical use.

Many foundrymen fail to carry separate molding subdivisions because they fear that this will involve

too much clerical expense. As a matter of fact, the clerical expense is almost negligible if a few simple short cuts are used. Indirect labor can be analyzed by running a test analysis for a short period, during which the time of every laborer is charged carefully to the molding department in which he is working. From this test the proportion of indirect to direct labor in each molding division is established, and these proportions then are used for the balance of the year to distribute total molding indirect labor to the various molding divisions. Supplies can be allocated to each division in proportions determined by test. Fixed charges are distributed only once at the beginning of the year, and thereafter the charge to each department remains the same every month. In this way the extra routine clerical work required to carry separate molding subdivisions can be reduced to a small amount, involving a few simple calculations, and little timekeeping.

Any foundryman who fails to carry separate molding divisions and to determine correct overheads in each division for fear of a little clerical expense, is being "penny wise and pound foolish." The error from using one flat molding overhead for all jobs is so great that it can lead to serious loss of profit—and subdivision is therefore worth while no matter what it costs. As a result of errors like this, and a general lack of attention to cost accounting and merchandising, many foundries are merely running public service institutions for the benefit of their customers. Standards of productive efficiency are fairly good in the foundry business, but standards of merchandising efficiency are still deplorably low. A little more attention to correct cost accounting and intelligent merchandising would enable many foundries, who are producing at low cost, to get the full benefit of their productive efficiency in actual increased profits.

Safety Rules Should Emphasize Courtesy To Prevent Driving Accidents

REGARDLESS of how carefully drivers are selected or how thoroughly they are instructed and trained they will not have accident free performance unless they can be made to think about safety, not alone as applied to themselves and their trucks, but as applied to others. This is another way of saying they must be courteous and courteous drivers are always safe drivers.

Summed in the fewest words the most important objective is to have every driver courtesy conscious. This should be the aim of the educational program that begins at the time a new driver is employed and should be continuous thereafter. Previous articles in THE FOUNDRY have emphasized various factors relating to selection and training of drivers.

The one most indispensable safety help is a set of drivers' rules. They should be provided to all drivers—old as well as new. The fewer the rules the more readily they will be memorized and hence the more faithfully they will be obeyed. Having a driver sign a receipt for the rules is good; still better is having him turn in the receipt after he has read the rules, and best of all is to have what he signs a combined receipt and pledge to obey.

Surprisingly few rules will cover the essentials—10 to 12 are usually ample. The following is an example of a safe driving pledge:

In co-operation with my employer and the local safety council in their efforts to reduce truck accidents and to prevent needless suffering and loss of life and property, I hereby pledge myself to operate my truck carefully and lawfully and to do all that I can to avoid accidents.

I further pledge, insofar as I can, to adhere to the following safe practices in the operating of my truck:

1. To make sure that my brakes are in good operating condition before I start each day's work.
2. To make sure that my horn and lights are in good working condition.
3. To see that the steering mechanism of my truck is always in good working condition.
4. To signal clearly — and look before backing.
5. To signal clearly—and look before pulling toward or away from curb.
6. In following other vehicles, to maintain sufficient space between cars to allow me to stop in case of emergency without hitting the car ahead, or subjecting my car to a collision from the rear.
7. In congested traffic always to operate my truck at such speed that I can stop readily in an emergency.
8. To observe and respect all traffic and boulevard stop signs.
9. To be prepared to expect the unexpected from pedestrians. Children especially call for extra care on the part of the drivers.
10. To play fair in traffic—drive as I wish others to drive.

Here as so often in safety work courtesy is stressed showing appreciation to the fact that if each driver is courteous accidents will almost cease.

Book Review

The Metallography of Iron and Steel, by C. Hubert Plant, cloth, 211 pages, 5½ x 8½ inches, published by Isaac Pitman & Sons, New York, and supplied by THE FOUNDRY, Cleveland, for $3.75 plus 15 cents postage, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House Westminster.

This new addition to the fairly extensive list of books dealing with the metallography of iron and steel is a welcome one as it discusses the subject from fresh viewpoint. Realizing that a sound theoretical knowledge of iron and steel is necessary to the student and practical man, the author has presented this ordinarily *hard-to-digest* subject matter in an atractive form without detracting from its importance.

The introduction defines briefly the various types of iron and steel, and is followed by a chapter on alloys which includes a discussion of the phase rule. The third chapter describes equilibrium diagrams beginning with simple examples before going to the more complicated types. Cooling and heating curves are explained in the next chapter, and crystallization in chapter V. Impurities in steel and alloy steels are discussed in chapter VI, hardening, tempering and annealing in chapter VII, and physical properties of iron and steel in chapter VIII. Chapters IX, X, XI, XII deal with cast iron, wrought iron, microstructure of steel, and micrography, respectively. Mechanical tests, X-rays, corrosion and mechanical properties are described in the remaining chapters.

Elects Officers

R. H. Brackenbury, Sterling Foundry Specialties Ltd., was elected president of the Foundry Trades' Equipment & Supplies Association Ltd., at the recent annual general meeting in London. G. T. Lunt, Bradley & Foster Ltd., Darlaston, Staffordshire, and A. C. Turner, London office of General Refractories Ltd., Sheffield, were elected vice presidents.

The National Society for the Prevention of Blindness, 450 Seventh avenue, New York, has published a bulletin carrying an article by J. Guy Jones, M. D., Dallas, Texas, entitled "The Eye Physician In Industry."

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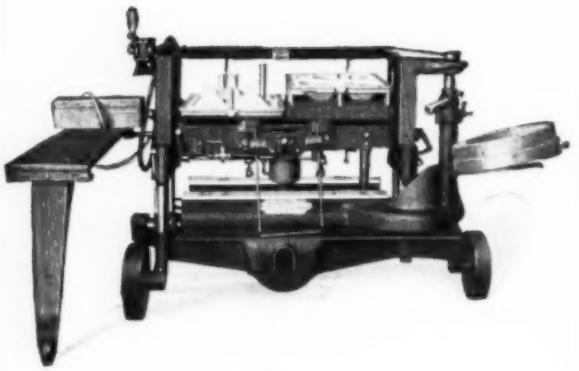

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Prevent Segregation of Bronze

(*Concluded from Page* 42)

Foundries rarely experience lead segregation trouble with yellow brass. Segregation may occur if the composition of the brass is not proper. An alloy containing from 60 to 66 per cent copper should not contain more than 3 to 4 per cent lead. A greater amount presents the probability of trouble arising from lead sweats.

Occasionally segregation appears in a yellow brass even where the composition is correct. The metal was not stirred properly. However, the segregation is so slight that it is not visible to the naked eye and the physical properties of the metal, as a rule, are not greatly impaired, with the exception perhaps of cast billets designed for extrusion purposes.

Brass rods of the following chemical composition: 62.50 per cent copper, 2.50 per cent lead and 35.00 per cent zinc, cracked adjacent to the weld during the process of welding them to copper rings. Microscopical examination of the grain structure near the fracture at 100 diameters magnification showed the presence of an excessive amount of lead as shown in Fig. 1. The grain structure 20 inches from the fracture exhibited a normal lead content as shown in Fig. 2. Evidently the metal before pouring had not been stirred properly and this resulted in the segegation of the lead.

Mechanics of Segregation

Lead segregation doubtless is the most common form of segregation in brass foundries. Before dealing with other metals it is necessary to discuss briefly the mechanics of segregation where the difference in specific gravity is not the cause.

A pure metal has a sharp melting point, above which all the metal is liquid and below which all is solid. The alloys under discussion have no sharp melting point. For each alloy there is a low temperature below which the alloy is all solid and an upper temperature above which it is all liquid. The melting range between these two temperatures may be short, as for some aluminum bronzes, or, it may extend over several hundred degrees as in leaded bronzes.

Part of an alloy is solid and part is liquid while passing through this melting range. If the two parts were of the same chemical composition, no segregation would take place. As a matter of fact they never are. The solid part of the alloy contains a higher percentage of the higher melting point constituent, and the liquid part contains a higher percentage of the lower melting point constituent of the alloy. For example, where an alloy of 90 per cent copper, 10 per cent tin is at a temperature within the melting range, the solid part contains over 90 per cent copper and less than 10 per cent tin. The liquid part contains less than 90 per cent copper and more than 10 per cent tin.

Since solidification starts at the walls of a mold and proceeds inward, the surface of a casting is richer in the higher melting point constituent, while the center is enriched in the lower melting point constituent. This is known as normal segregation, as in steel ingots where the impurities, sulphur and phosphorus are concentrated in the center.

Zinc shows no tendency toward segregation in brass or bronze. With a boiling point near the solidification temperature of ordinary brass or bronze, the zinc atoms move about and diffuse rapidly while solidification takes place. The difference in zinc content between the solid and the liquid portions of an alloy in the process of solidification decreases so that when the alloy becomes solid, there is practically no evidence of zinc segregation.

Tin and phosphorus segregate, but instead of concentrating in the center, these elements migrate to the surface of castings where the manifestation is known as *tin sweat*. This inverse type of segregation is promoted by a slow cooling rate and is caused by the contraction of the metal which forces the liquid tin-rich constituent through the crust of solid crystals.

Crystallization starts at the walls of a mold. The crystals grow in a direction at right angles to the mold surface. They are known as dendrites and the grain structure a dendritic or pine tree structure as shown in Fig. 3. Rapid solidification results in a large number of small and closely packed dendrites. The interdendritic, tin-rich filling therefore is scattered about and cannot penetrate the solid crust of closely packed dendrites when the metal contracts on cooling.

Dendrites Are Larger

Where the solidification proceeds slowly, the dendrites are larger and comparatively few in number. Consequently, the crust of dendritic crystals presents a weak and porous structure. When the metal contracts on cooling the interdendritic filling oozes out. As might be expected this metal oozes out on the surface of heavy sections and on top of risers.

The hotter a casting is poured, the more pronounced is the average segregation. Figs. 4, 5 and 6 show sectional views of risers poured at different temperatures. The riser in Fig. 4, poured at the highest temperature, exhibits the largest quantity of exuded metal, while the riser in Fig. 6, poured at a lower temperature, shows no exuded metal.

The following alloys commonly used in brass foundry practice are subject to inverse segregation: 90 per cent copper, 10 per cent tin, deoxidized with phosphorus; 89 per cent copper, 11 per cent tin, deoxidized with phosphorus, and 88 per cent copper, 10 per cent tin and 2 per cent zinc.

Trouble sometimes is encountered in making screw down nuts from these alloys. The segregation portion of the alloy, high in tin and phosphorus is exceedingly fluid and may penetrate the core sand, thus creating a porous area in the threaded section of the casting. The obvious remedy is to pour the metal at a comparatively low temperature and to chill the section to be threaded.

Gives Typical Analyses

The following comparative analyses are typical, showing the effects of inverse segregation upon the chemical composition of bronzes: Exuded metal from a phosphor bronze gear alloy (S.A.E. Spec. 65) containing 88.86 per cent copper, 10.41 per cent tin, 0.34 per cent phosphorus, 0.04 per cent iron and 0.35 per cent zinc, analyzed 79.07 per cent, copper, 19.63 pef cent tin, 0.83 per cent phosphorus, 0.04 per cent iron and 0.43 per cent zinc.

A leaded gun metal casting (S.A.E. Spec. 63) had a number of exuded beads on top of the risers. The average analysis of these beads was 78.85 per cent copper, 17.61 per cent tin, 2.84 per cent lead, 0.31 per cent phosphorus, 0.03 per cent iron and 0.36 per cent zinc. The analysis of the original composition was 87.20 per cent copper, 10.22 per cent tin, 2.05 per cent lead, 0.18 per cent phosphorus, 0.03 per cent iron and 0.32 per cent zinc.

The foregoing example also shows that lead participates in inverse segregation. The low melting point of lead makes it one of the elements concentrating in the interdendritic filling.

The statement that slow solidification promotes inverse segregation easily can be demonstrated in making bronze ingots. Where the 88 per cent copper, 10 per cent tin and 2 per cent zinc alloy is poured into ingot molds of ordinary temperature, the ingots show a well developed shrink cavity and no exudation of metal. Where these ingots are dumped as soon as the metal has set and some of the same alloy is poured into the hot molds, liquid metal from the interior oozes out and forms a number of beads on top of the ingots a few seconds after the surface metal has set. In one case chemical analysis of the beads showed 75.21 per cent copper, 22.86 per cent tin, 0.06 per cent iron, and 1.87 per cent zinc. The original alloy contained 88 per cent copper, 10.10 per cent tin, 0.06 per cent iron and 1.84 per cent zinc.

Effect of Chromium on Cast Iron

(*Concluded from Page 43*)

cylindrical castings 2½-inch in diameter were sectioned to determine porosity. Presence of 0.50 per cent chromium resulted in a distinct decrease in porosity. No measurements of the relative density were made in the present series of tests, but other investigators have reported that small additions of chromium refine the grain and increase the density of cast iron.

Chromium gradually increases the hardness when the iron is cast in standard arbitration bars, 1.20-inch in diameter, as indicated in the table.. With a cast-iron base having a hardness of 145 to 165, addition of chromium increases the hardness progressively until, with 0.50 per cent chromium present, it is about 190 to 200 brinell. For purpose of calculation, it may be assumed that each 0.10 per cent of chromium in this type of iron causes a rise in hardness of approximately 8 to 10 points brinell.

When a cast iron has an original hardness around 200 brinell the relative increase in hardness on the addition of small amounts of chromium apparently is much less marked. This can be seen in the cast irons of test 2.

Prevents Excessive Softening

To test the influence of section on the relative hardness of plain and chromium-treated cast iron, telescope castings were made from the three irons shown in the accompanying table, test 2. These irons contain no (0.01 per cent) chromium, 0.48 per cent chromium and 0.79 per cent chromium respectively. Sections larger than 2½ inches in diameter were cast only of the irons containing no chromium and 0.79 per cent chromium. The presence of only 0.48 per cent chromium is sufficient entirely to prevent softening on an increase of section from ¾ to 2½ inches. With 0.79 per cent chromium present the hardness of a 6½-inch section does not fall below approximately 180 brinell, as compared to a drop in hardness to 143 brinell in the iron receiving no chromium addition. It is apparent that a small addition of chromium is effective in preventing excessive softening of the cast iron in heavy sections.

Different grades of cast iron show varying levels of physical properties but in every instance tested the strength of the irons has been increased by the addition of chromium. This improvement in strength varies from 5 to 31 per cent in the present tests. The deflection is in general higher than that of the unalloyed iron until the chromium exceeds 0.50 per cent.

The series of cast irons of test 1 containing from 0.03 to 0.52 per cent chromium were annealed for 3 hours at both 650 degrees and 750 degrees Cent., and furnace-cooled. After the 650 degrees Cent. treatment, the specimens were examined in regard to structure and hardness. It was found that the presence of 0.52 per cent chromium prevented softening, the final brinell hardness being 192. The same stabilizing influence was exhibited to a lesser degree by chromium contents of 0.26 and 0.37 per cent, a hardness of 168 and 180 respectively being maintained. The chromium-free iron submitted to this same treatment showed a drop in brinell hardness to 140.

Influence of chromium on preventing excessive softening was even more evident after the 750 degrees Cent. treatments. Hardness of the chromium-free iron fell to 110, while with 0.26 per cent chromium present a brinell hardness of 140, and with 0.52 per cent chromium, a brinell hardness of 180 was retained. This influence of small amounts of chromium on preventing excessive softening assumes particular significance when heat treatment, such as annealing to remove casting strains, is necessary. A small amount of chromium decreases the growth of cast iron to a remarkable degree.

The opinion that chromium considerably increases wear resistance of cast iron is widespread, and this metal frequently has been added to cast irons that must resist abrasion. No wear tests were performed on the irons herein described owing to the difficulties involved in this type of testing. However, it is pertinent to refer to the comprehensive investigation of the comparative abrasion loss of different cast irons made by Klingenstein, who shows the marked effect of chromium in lowering abrasion loss. This is evident with a chromium addition of 0.4 per cent. It has been demonstrated also that chromium cast irons are particularly suitable for castings subjected to sliding wear at elevated temperatures, because of their increased resistance of heat.

Machinability Unchanged

No difference in machinability was noted with additions of chromium up to approximately 0.80 per cent. In addition, machining tests run by an independent machine shop on the various steps of the telescope castings previously described failed to show any definite variation in machinability between the chromium-free and chromium-bearing castings in the various thicknesses. This fact has been checked by other experience and is particularly stressed because of various current opinions to the contrary. These opinions generally are based on work with irons of appreciably lower silicon content than the optimum. No marked drop in machinability has been noticed in chromium cast iron until its hardness approaches 285 brinell. However, this is true only of cast iron in general if the hardening is brought about by chromium additions and not true if the iron is hardened by lowering the silicon content, by reducing the section size, or by chilling.

It was noticed particularly that a small addition of chromium was effective in rendering the cast irons completely pearlitic. These irons, in the absence of chromium, contained an appreciable amount of free ferrite. For example, 0.26 per cent chromium was sufficient to render cast iron 2-A of test 1 almost completely pearlitic as cast in the standard arbitration bar.

This pearlitizing action of chromium is sufficiently strong to preserve a pearlitic structure even with the section of a casting considerably increased. In addition, chromium stabilized and maintained a pearlitic structure even on exposure of the

(*Concluded on Page 84*)

Improves Properties

THIS investigation shows that additions of small amounts of chromium, from 0.25 to 0.50 per cent, reduce a definite improvement in the strength, deflection and density of the cast irons investigated. Additions also provided an improvement in uniformity of hardness in varying sections, particularly with respect to the retention of hardness in heavy sections.

It was found that an improvement in heat resisting properties of cast iron resulted from small chromium additions. This improvement is related to a stabilization of the pearlitic structure of the irons and an increased resistance to growth at high temperatures. Data indicated that the machinability of cast irons containing small amounts of chromium is not affected adversely, although the hardness is increased moderately.

The article is from a paper presented at the Buffalo meeting of the American Institute of Mining and Metallurgical Engineers.

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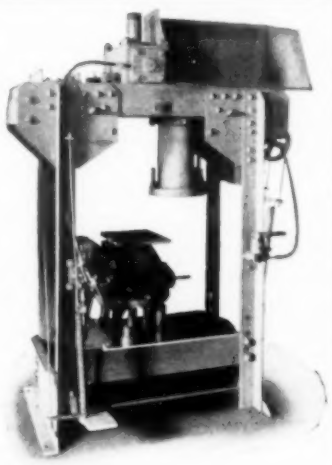

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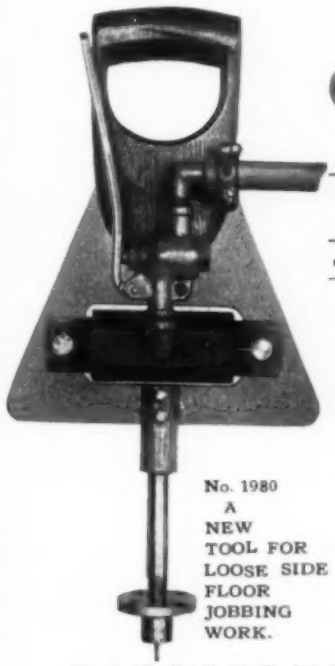

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(*Concluded from Page 82*)

cast irons to relatively high temperatures, as was evident in the annealing tests.

This specific effect of small amounts of chromium on the structure of cast iron undoubtedly explains to a large extent the results obtained in the present experiments, as a pearlitic cast iron is considered the most suitable for high strength, density, and wear resistance accompanied by good machinability.

It has been reported by other investigators that chromium refines the graphite. This observation has been found to be true in regard to cast irons tending to form large graphite flakes, but in the present tests it was particularly noticed that the presence of chromium produced in addition a more uniform distribution of graphite and tended to prevent the formation of objectionable ferrite areas containing eutectic graphite.

Casts Electric Steel Centrifugally

A new process for casting steel blooms for rolling recently has been developed by the Rotary Electric Steel Co. Detroit, and a plant having a monthly capacity of 7500 tons now is under construction. In this process, 100 per cent steel scrap is charged into an electric furnace, the melt is poured quickly into a mold revolving at high speed, the resulting circular bloom is sheared into the required number of arcuated sections which are heated to rolling temperature by a flash heat.

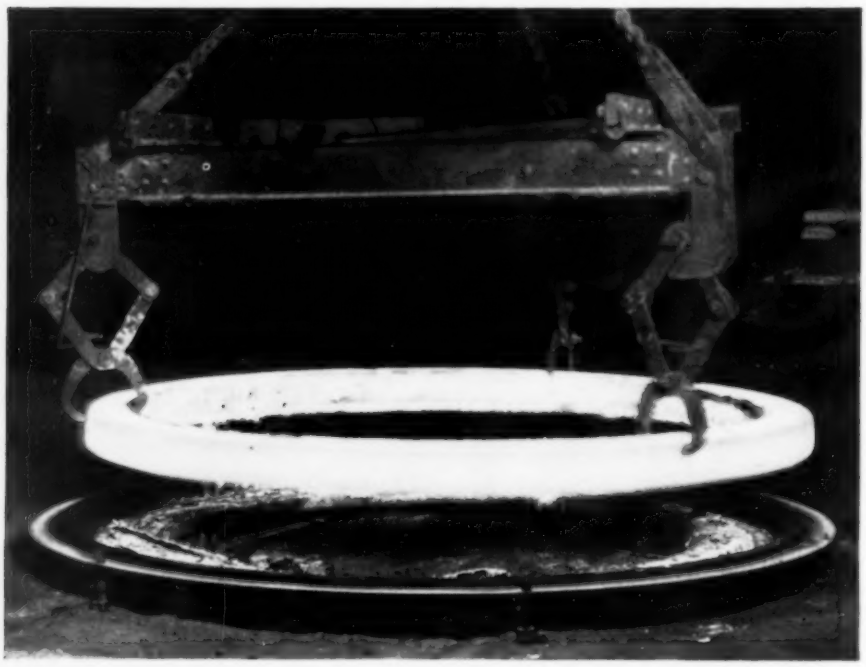
The first rotary casting machine was installed in the fall of 1928 in the plant of the Machined Steel Casting Co., Alliance, O., where acid open-hearth steel was available. This unit had a rotor diameter of 10 feet, and a mold cavity 4 x 4 inches, which permitted a 4 x 4-inch circular billet, 31½ feet long when straightened, to be cast.

The operation of the machine was so satisfactory from a mechanical standpoint that in 10 minutes from the time the steel was poured into the rotating mold, the billet was produced, ready for cutting and straightening. To secure a billet of basic steel weighing in excess of 2000 pounds, a much improved machine was designed, constructed and installed at the plant of a manufacturer of high-grade steels in Canton, O., in the summer of 1930.

In this location, steel of practically any desired analyses and at the required temperatures was available. This machine was operated until the conclusion of development work in June, 1932; it showed no mechanical weakness and required only routine attention in the way of lubrication, etc.

This casting unit includes a rotary table mounted on a vertical spindle. The latter is carried on tapered roller bearings and is driven through gears by a motor of small capacity. The entire machine is installed in a pit which is provided with the proper safeguards to eliminate the possibility of accident. A circular mold, 10 feet in diameter and designed for 6 x 6-inch blooms weighing approximately 3000 pounds, is mounted on a table in such a way that it can be removed easily. A removable bridge, which supports a pouring box, an insulation depositing device and other accesories, spans the table.

The process is claimed to produce a nondendritic steel, a steel so closely grained as to be practically free from banding and directional properties in the cast and rolled states.



When the steel has solidified and still is at a high temperature, the molds are removed from the machine and the ring stripped

Pittsburgh Group Elects Zoerb President

George H. Zoerb, Sharpsburg Foundry Co., Sharpsburg, Pa., Pittsburgh district, was elected president of the Pittsburgh Foundrymen's association at its regular monthly meeting held at the Ft. Pitt hotel, May 22. He succeeds Thomas A. Reynolds, McConway & Torley Corp., Pittsburgh, who was president for the 1932-1933 year.

C. E. Davis, Homestead Valve Mfg. Co., Pittsburgh, was named vice president and William J. Brant, secretary and treasurer. An executive committee composed of the following was also elected: T. A. Reynolds, McConway & Torley Corp., S. B. Cuthbert, Carnegie Steel Co., F. C. T. Daniels, Mackintosh-Hemphill Co., and H. P. Spilker of the Sterrit-Thomas Foundry Co.

Tragedy marked the occasion when H. F. Seifert, superintendent of the foundry and micarta division of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., the principal speaker of the evening, died suddenly just a few minutes after he had begun his address. Mr. Seifert succumbed to chronic myocarditis, a heart ailment, and died in the Ft. Pitt hotel. Mr. Seifert's name had been put by the nominating committee for a member of the executive committee for the next year, 1933-1934, and he had just been elected a few minutes before, in addition to the four previously mentioned names.

The next meeting of the Pittsburgh Foundrymen's association will be held June 19, also at the Ft. Pitt hotel. A representation from the association is planning to attend the convention and exposition of the American Foundrymens association to be held at the Stevens hotel, Chicago, from June 20 to June 23.

Moves Main Office

Worthington Pump & Machinery Corp., Harrison, N. J., recently moved the general and executive offices, formerly located at 2 Park avenue, New York, to its new office building located adjacent to the plant at Harrison. Local sales office will be continued at 2 Park avenue, New York.

H. H. Moss, Linde Air Products Co., New York, recently was awarded the Samuel Wylie Miller Medal by the American Welding society.

Bonds Sand Molds with Cement

(*Concluded from Page 45*)

Any metal, such as iron, steel, bronze, aluminum, and their alloys, can be poured in such molds. There is no reaction between the mold and the metal, which remains still. Due to the time needed for setting, this process is not especially adapted for mass production work with green sand molds, requiring continuity between the molding and pouring stations. It is adaptable to any work usually requiring dried molds.

The fact that steam is released from the molds during pouring indicates that these retain a certain amount of moisture. Actually, the operation is similar to that which takes place with green sand molds for any metal, and for castings of any size or weight. Castings weighing up to 15 tons have thus been made in cast-iron and steel. The free evacuation of gases is insured by the extreme permeability of the molds, and such defects as scabs, blowholes, etc., are avoidable. The fact that it is not necessary to dry the molds in ovens avoids any distortion of the molds, and the same applies to cores, which also are made readily from the sand-cement mixture.

These molds give a good skin to the castings, but they can be painted with any good blacking, the water being easily absorbed, as the material of the mold is hygroscopic. For cast-iron and bronze, molds can be made entirely with old recuperated sand-cement mixture. For steel castings, new mixture must be used as facing sand, and old mixture can be used for backing.

Molds Resist Pressure

When the molds are closed, the cope and drag are assembled by light steel sections fixed outwardly by adjustable hooks, or they are simply weighted with weights or iron pigs. When completed, the molds are claimed to offer a greater resistance to pressure on the part of the metal than green sand molds, thus providing castings of precise dimensions. It generally is not necessary to join the molds with cement, although this is recommended for cast-iron molds, due to the fluidity of the metal.

The mixture also can be used for molding with a strickle board, as is done in the usual loam-molding processes. As has been said, the same mixture that is used for making molds can also be employed for average core-making without any special precautions. For particularly delicate cores, special care must be taken, the same as would be the case if these cores were made with the usual core sand and binders.

Cohesion of the mixture at the time the mold is made is not equal to that of clay-bonded sand. Therefore, the patterns and frames must be in good condition and properly varnished, and a rollover machine is recommended for stripping the pattern from the mold.

After the molds have been poured and the metal has cooled, the molds are thrown at the shaking-out station on some steel or iron bars, where they are easily broken up. They are then conveyed to the crusher at the sand-preparing plant.

The foundry at Ugine operates exclusively for steel castings, of an average weight of 330 pounds and a maximum weight of 16½ tons. The tonnage averages about 12 tons per day. The foundry is 328 feet in length, and the width in the wider part is 118 feet. Sand is brought by rail outside the sand-preparing plant and is elevated to bins. Other bins contain the old mixture of sand and cement coming from broken-up molds after it has been crushed and a bin has been provided for the cement.

Crush Old Molds

The sand-preparing plant includes a crushing mill to finish breaking-up used molds, a mixing mill where the sand and cement are mixed in the required proportions, and a humidifier. Broken-up molds are conveyed from the shaking-out station to the crushing mill in buckets guided by an aerial monorail. An elevator takes the old mixture from the crushing mill to the storage bins.

New sand and cement are dropped from their respective bins, through a hopper, into weighed trucks, and the mixture is taken to the mixing mill, which is of a similar type to those used for ordinary sand. Water is added during the mixing, the amount being fixed in accordance with the composition. The mixture is prepared in relation to the amount of sand required at the molding stations. Too much sand must not be prepared in advance, because it would begin to set before it could be used.

The mixture of sand, cement and water is taken by monorail, in buckets, and dumped in bins at the molding stations. One rollover, pattern draw molding machine is used. Other molds are made by hand but the patterns are stripped on the rollover machines. Patterns are made ready by platforms at the back of the molding stations. Finished molds are pushed on to roller conveyors and placed on the racks, which are lifted by an overhead traveling crane and layed down to dry in an area beyond the molding department.

A hand-molding station is located in the center of the plant. Cores are prepared at the back of the hand station and placed on the racks. Apart from one core-making machine, the cores are made by hand. When dry, they are placed on racks and taken to the front part of the shop, where the cores are placed into the dried molds; then the molds are closed up and assembled, moved forward on conveyors and then placed on the racks. These racks are taken by the overhead crane to the pouring station.

Steel is supplied by a battery of electric furnaces situated at the right of the foundry shop. Filled molds are pushed along rollers, and when the metal has cooled they arrive at the shake-out station, against the wall which separates the pouring station from the sand-preparing plant. The broken-up molds are taken to the crusher, and the castings are taken by trucks to the cleaning station.

Point System For Setting Rates

M. A. Harder, superintendent, Lakeside Malleable Casting Co., Milwaukee, led the discussion of estimates made from blueprints at the regular meeting of the Malleable club held May 9 at the Old Heidelberg Inn, Milwaukee. Twenty-five members of the club were present.

M. W. Gleisner, superintendent, Walker Mfg. Co., Racine, Wis., discussed the point system of setting molding rates, as applied to the jobs using match instead of plate patterns. Mr. Gleisner has found the present factor unsatisfactory in the case of match patterns. The secretary of the club was instructed to gather data on which a committee, to be appointed at the June meeting, can base a recommendation.

Companies Consolidate

Worthington Pump & Machinery Corp., Harrison, N. J. and Gamon Meter Co., Newark, N. J. have consolidated operations in the manufacture and sales of meters, through the newly organized Worthington-Gamon Meter Co. Sales headquarters for the company have been established at Harrison, N. J. and manufacturing operations will be concentrated at the Gamon plant, Newark. E. T. Fishwick is president, G. H. Gleeson, vice president in charge of sales, J. A. Bonnet is secretary, and R. R. Anderson, works manager.

Fred E. Wolf has been appointed sales engineer in the Pittsburgh district for the W. W. Sly Mfg. Co., Cleveland. Mr. Wolf has been engaged in the engineering and sale of blast cleaning equipment and positive dust collection for 17 years.

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Foundrymen's Handbook

Table of Contents

Section I.	General Foundry Data	Section IV.	Nonferrous Metals and Alloys
Section II.	Computing Weights		
Section III.	Reference for Pattern Makers	Section V.	Specifications
		Section VI.	Miscellaneous Tables

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European Foundry Practice

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Bronze Castings

Comments on the Factors Affecting the Soundness of Bronze Castings, by E. J. L. Howard, the *Foundry Trade Journal*, London, May 4, 1933.

Unsoundness or porosity in bronze castings may arise from a number of causes; for example blow holes, sand inclusions, dross, cold shut, release of absorbed gases upon solidification, and faulty pattern design which may result in shrinkage holes or cracks. These defects can arise and be influenced during the melting practice by a number of factors, such as casting temperature, impurities in the metal, condition of sand, etc.

Liquid shrinkage, solidification shrinkage, and solid shrinkage are discussed, as well as the effect of gases on the soundness of a casting, the oxide of copper formed when copper is melted and which must be removed from the metal, melting operations, casting temperature, methods of gatings and the effect of impurities.

The unsoundness in bronze castings may be reduced greatly, and in many cases eliminated, by attention to several factors. Close co-operation is necessary between the foundry and the designer to provide a casting design which gives as uniform a section as possible. Use of good raw materials where the composition is known, correct and rapid melting practice if possible in a neutral atmosphere or alternatively slightly oxidizing, and the correct pouring temperature for the type of alloy or casting, also are essential. The last factor, in conjunction with the method of gating, probably is the most important.

Cores in Loam

Cylindrical Cores in Loam (Noyaux Cylindriques en Terre), by the Technical Committee of the Belgian foundry association. Final instalment. Rapporteur: M. Vandendries. *La Fonderie Belge*, Liege, January, 1933.

This article concludes the series previously abstracted and describes special cylindrical cores made by loam molding methods. The descriptions cover cores of large dimensions for vats with convex bottoms and cores for calendar rolls, where thicknesses must be regular and even.

Molding Sands

Introduction to the Study of Molding Sands (Introduction a l'Etude des Sables de Moulage), by L. F. C. Girardet. *Bulletin* de l'Association Technique de Fonderie de Paris, February, 1933.

The author gives a summary of the constitution of sand and of the mechanism of its use for preparing molds. This section also explains how the properties of the sand can be destroyed by erosion, ferrostatic pressure, heat, and chemical action. The second part deals with grading sand. First, the clay is separated by introducing the sand, which has been previously dried, in a bottle containing distilled water. The bottle is then rotated in a machine until the clay is separated from the grain.

The author has conceived a special pulsometer actuated by a vacuum effect. This apparatus contains a number of sieves. The contents of the bottles in which the sand grains have been separated from the clay are poured into the pulsometer, and the grains are separated into six grades. The liquid containing the clay is then treated by floculation in another apparatus, after which it is collected and dried.

A diagram can be made showing the proportion in volume of the six grades of grains, and of the clay for a given sand, by horizontal lines traced above a base line. If the sand is again tested after a period of use, the changes in the volume of each grade and of clay can be seen by comparison with the first diagram. The grains are then examined through the microscope. A dilatometric study can also be made, and the determination of the specific weights of the grains. The author then gives a theory of the origin of the clay bond, and of its properties in relation to the grains, and finally explains the properties of the sand as a molding medium.

New Annealing Cycle

Graphitization of White Cast Iron (Ueber die Graphitisierung von weissem Gusseisen), by A. Merz and H. Schuster, *Die Giesserei*, Dusseldorf Germany, April 14 and April 28, 1933.

This article relates to a study of the so-called quick-anneal processes for malleable cast iron, and describes a number of investigations that the authors pursued to determine various factors that have or might have any effect in promoting a more rapid conversion of the original cast structure into ferrite and temper carbon. Their work led to the development of a new cycle for annealing which shows considerable promise from the laboratory viewpoint, and which may have commercial application if furnaces can be constructed to meet the suggested conditions provided through the investigation.

Essentially the process involves heating the castings to 1976 degrees Fahr. (1080 degrees Cent.) in 1 hour and holding at that temperature for 2 hours. Then the temperature is dropped to 1292 degrees Fahr. (700 degrees Cent.) in 1 hour. For the next 12 hours the temperature is varied between 1292 degrees Fahr., and 1436 degrees Fahr. (780 degree Cent.) at a regular rate of two oscillations per hour. At the end of that period the temperature is varied in a similar manner between 1310 degrees Fahr. (710 degrees Cent.) and 1400 degrees Fahr. (760 degrees Cent.) for 10 hours, and then allowed to cool to handling temperature.

Exclusive of the heating up period, the cycle occupies 25 hours, and the authors claim that complete graphitization is obtained. The metal used in the experiments contained 2.46 per cent total carbon; 0.96 per cent silicon; 0.08 per cent phosphorus; 0.047 per cent sulphur, and 0.52 per cent manganese. The latter is considerably higher than ordinarily found in blackheart malleable, and the authors believe this indicates the practicability of their process since high manganese lowers graphitization of the pearlite.

A. S. T. M. Program Carries Much on Castings

Many papers and discussions of interest to the foundry industry will be presented at the annual meeting of the American Society for Testing Materials, to be held in the Stevens Hotel, Chicago, June 26-30. One of the features of the program dealing with cast products is the symposium on cast iron on Monday morning, June 26. The object of the symposium is to provide the engineering profession with authorative data in concise form on the properties of gray iron castings made by the best present methods of production, and is the third of a series sponsored jointly by the A.S.T.M. and the A.F.A.

A session on "Cast Iron, Effect of Temperature on Metals" will be held Monday afternoon, and will include the report of committee A-7 on malleable castings, and the report of committee A-3 on cast iron. The malleable committee will recommend adoption as standard of tentative specifications for malleable castings to supersede the present standard specification for that product. The gray iron committee will present an extensive report on impact testing and will recommend the adoption as standard of tentative specifications for gray iron castings.

The program for that session also includes an informal report of the sectional committee on specifications for cast iron pipe and special castings; a report of the joint research committee of the A.S.M.E. and the A.S.T.M. on effect of temperature on properties of metals; and papers on "Creep and Structural Stability of Nickel-Chromium-Iron Alloys at 1600 Degrees Fahr." by W. A. Tucker and S. E. Sinclair, U. S. Bureau of Standards, and "Studies on Creep of Metals Using a Modified Rohn Test," by C. R. Austin, Westinghouse Electric & Mfg. Co.

A session covering steel on Tuesday morning will include a report of committee A-4 on the heat treatment of iron and steel; report of committee A-6 on magnetic properties; report of committee A-1 on steel; and an informal report of the joint committee on investigation of the effect of phosphorus and sulphur on steel. A session on the corrosion of metals will be held Thursday afternoon, June 29.

The session on nonferrous metals on Friday afternoon will include a report of committee B-2 on nonferrous metals and alloys; report of committee B-5 on copper and copper alloys cast and wrought; report of committee B-4 on electrical heating, electrical resistance and electric furnace alloys; report of committee B-6 on die cast metals and alloys, and papers covering "Effect of Addition of Lead on the Hardness of Certain Tin-Base Bearing Alloys at Elevated Temperatures," "A Comparison of Certain White Metal Bearing Alloys Particularly at Elevated Temperatures," and "Effect of Impurities, Iron and Sulphur, on the Physical Properties of Cast Red Brass."

A Century's Debt to Castings

(*Concluded from Page* 26)

pointing the way to what lies ahead may be found in the electrical group. The General Electric Co., Schenectady, N. Y., and Westinghouse Electric Mfg. Co., East Pittsburgh, Pa., in addition to showing their products of the present will give in visual form prophecies that stir the imagination. Today's research accomplishments in electrical lines become tomorrow's luxuries, and necessities the day after.

At every stage in the development of electrical manufacturing, transmission and power application units, castings have performed a service in the past. It is not unreasonable to cast the imagination in advance and while viewing the wondrous prophecy of the future as involved in the spectacular demonstration of the research activities of the large electrical concerns, to venture a modest foundry forecast. Whatever the trend, regardless of the unknown conveniences, utilities, luxuries and necessities that lie over the hill, castings will have a prominent part in their accomplishment and realization.

British Hear Steel Castings Report

Discussions of interest to foundrymen at the 64th annual meeting of the British Iron & Steel institute, held in London on May 4 and 5, included the first report of the steel casting research committee, presented by Dr. R. H. Greaves, research department, Wolwich. A considerable part of the work affected by this committee was based on the experiments made with 16 castings weighing about 250 pounds, and made to the same design under various conditions, each variable being defined as fully as possible in the report of the work.

Sir Robert Hadfield, who opened the discussion, said that the examples given in the report could not be expected to represent the wide variety of ordinary practice. After mentioning that hydraulic cylinders, several feet in length, with walls 1½ inches thick, have been produced quite satisfactorily, he said that the following points would help to meet any troubles: Articles must be designed adequately; sharp corners are to be avoided; the nature of the steel employed is of great importance; steel should be tested in the form of a green sand specimen before being poured into the mold and close contact should be maintained between the molder and the metallurgist.

In further discussion it was pointed out that the report lost considerable usefulness in having considered only one type of casting and the hope was expressed that the work would be pursued and extended considerably. Another speaker pointed out that piping or segregations always occur in a steel ingot, the most simple form of casting. He suggested that theoretically the casting can be considered as composed of a number of ingots joined together and that therefore, it hardly is reasonable to expect that sound castings can be secured easily or in a simple manner. Another speaker stressed the importance of using short runners to have the steel at a uniform temperature as far as possible.

J. E. Hurst, Sheffield, presented a paper on "The Influence of Phosphorus on the Properties of Hardened and Tempered Cast Iron." Victor Stobie, past president of the Institute of British Foundrymen, pointed out that in the past it was thought that hardening and tempering would spoil cast iron, but now it can be seen that such treatment vastly improves its quality. He pointed out that in trying the electrical resistivity of a cast iron around 100 degrees Cent., he found, contrary to expectation, that the resistance was lowered as the temperature increased.

J. G. Pearce, director of the British Cast Iron Research association, recommended a careful study of the author's previous work on the subject. Professor Thomas Turner remarked that so much work has been done on cast iron that it almost has become a new material. The foundry section of the meeting included a paper on "The Effect of Sulphur and Phosphorus on the Corrosion of Iron" by L. Tronstad and J. Sejersted, Trondheim, Norway.

Appoint Sales Agent

Kerchner, Marshall & Co., 1415 Oliver building, Pittsburgh, has been appointed agent in Pittsburgh and Cleveland territory by the Sloss-Sheffield Steel & Iron Co., Birmingham, Ala. for pig iron. The Cleveland office, at 627 Union Trust building, will be in charge of Clay P. Hellwig, who for 16 years was connected with Rogers Brown & Crocker Bros. Inc.

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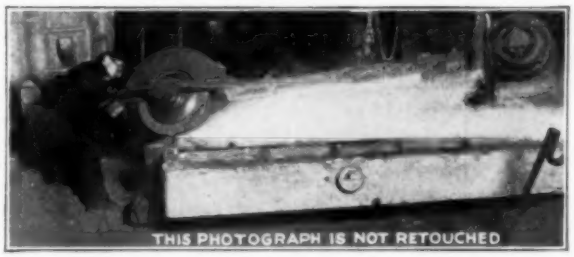

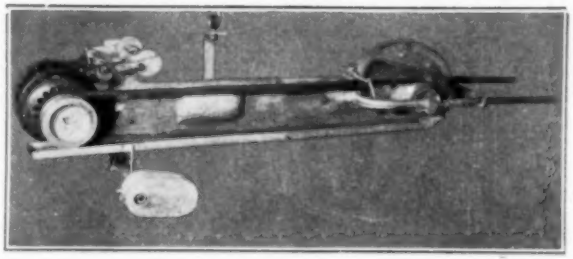

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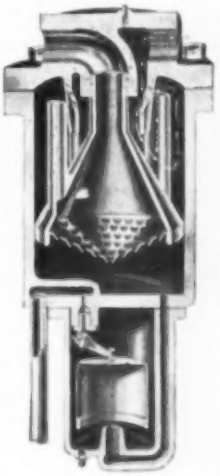

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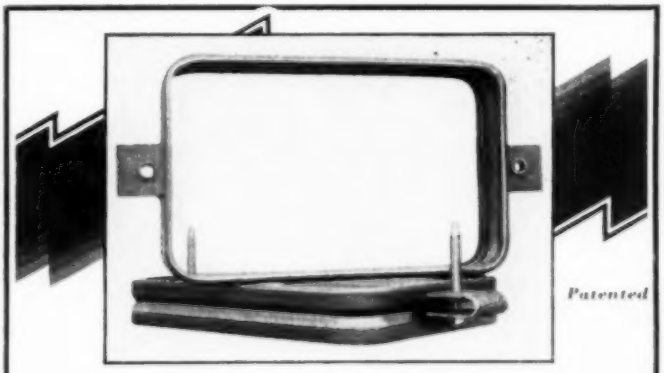

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Obituary

H. F. SEIFERT, whose death during the May meeting of the Pittsburgh Foundrymens association is reported elsewhere in this issue, was superintendent of the foundry and micarta division of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Seifert received his technical training in mining and metallurgy at Columbia university, New York, and was graduated from that institution in 1906. For the following 6 years he was associated with the Nichols Copper Co., Laurel Hill, N. Y., and the following two years were spent at the Baltimore plant of the American Smelting & Refining Co. in charge of the anode casting department. Since 1916 he has been associated with the Westinghouse Electric & Mfg. Co., originally joining that firm to build a copper furnace for reclaiming scrap copper. Since that time he has devoted considerable attention to the reclamation of various nonferrous scrap metals. Mr. Seifert has been active in the work of both the American Foundrymen's association and the Pittsburgh Foundrymen's association. He was a member of the advisory committee, nonferrous division, of the A. F. A., chairman of the subcommittee to formulate recommendations for design of nonferrous castings, and a member of the recommended practices committee of the nonferrous division. In 1932 he served as a member of the nominating committee. He was a past president of the Pittsburgh Foundrymen's association and a member of the executive committee of that group.

J. W. Bettendorf, 68, president, Bettendorf Co., Bettendorf, Iowa, died May 17. Starting as machinist in a plow works at Peru, Ill., he ultimately headed the freight car building and repair company bearing his name.

John A. Ubsdell, 66, president and general manager, Great Lakes Engineering Works, Detroit, died May 15. He became associated with the Chicago Shipbuilding Co. in 1890, going to Detroit in 1902 as superintendent of the shipbuilding division of the newly-organized Great Lakes Engineering Works.

Edward L. Sturgis, 76, for many years connected with the foundry industry in New York state, died at his home in Medina, N. Y., May 6. Mr. Sturgis served as general manager of the Bignall Co. and the Central Foundry Co. of Medina for many years and later organized the Medina Iron & Brass Co., and also the Buddington Foundry Co. in Albion, N. Y.

William H. Hassenplug, 69, former vice president, Harnischfeger Corp., Milwaukee, died May 9. Mr. Hassenplug was born in Mifflenburg, Pa., and attended Bucknell college, entering business with William Sellers

H. F. Seifert

& Co. Inc., Philadelphia. He joined the Pawling & Harnischfeger Co., now the Harnischfeger Corp., Milwaukee, in 1900 and retired a year ago.

Book Review

Cours de Fonderie, Tome I—Notions Generales (Course of Foundry, Vol. I—General Notions), by M. F. Renaud, with a preface by E. V. Ronceray. Paper 568 pages, 10 x 6½ inches, published by Librairie de l'Enseignement Technique, Paris, France, and supplied by THE FOUNDRY and in Europe by the Penton Publishing Co., Ltd., Caxton House, Westminster, London, S. W. 1.

The complete course will comprise three volumes; the first, dealing with general notions, is intended especially for foundry foremen; the second intended for foundry managers, will deal with processes, and the third, for engineers, will cover metallurgy and control of manufacture.

The author was one of the first to come out with honors from the High School of Foundry, of Paris, and has since been associated closely with E. V. Ronceray in propounding and developing sound principles among foundry workers who have the ambition to become leaders in their industry.

Volume I follows the program of the examination for entry into the French High School of Foundry, and is intended for those who already have a minimum of knowledge of foundry practice.

The main object of the book is to enable the foundry worker to use his intelligence and to understand the why's and wherefores' of the different operations which he has to perform. He then becomes able to use his own initiative, find solutions to the many problems that present themselves in day-to-day practice, and to find the causes of failures. He becomes equipped to rely more on his judgment than on his memory, and finally to direct the work of others.

The book contains 19 chapters, and begins with the general theoretical study of molding. This study is made before that of patterns because, the author explains, a pattern can only be utilized with the method of molding for which it has been made. Chapter II follows with the general study of loam molding. Chapter III deals with general notions on pattern-making, while Chaptel IV describes flasks and the equipment used in loam molding. Molding sands are dealt with in chapter V, which gives the properties, classification, treatment and control of sands. Chapter VI discusses the various methods of molding, and chapter VII gives the principles of the different types of molding machines. Chapter VIII deals with core-making, and the drying of cores and molds is covered in Chapter IX.

Chapter X deals with melting, and compares the various types of furnaces used, including cupolas, crucible and open-hearth furnaces, converters, rotary and electric furnaces. There is a section on refractories and one on the measurement of temperatures. Chapter XI, on pouring, covers general principles, gates, runners and heads, and the equipment used at the pouring station.

Cleaning and fettling is dealt with in Chapter XII, and castings defects in chapter XIII. Chapters XIV and XV deal with control of manufacture and heat-treatment respectively. Both subjects will be developed in Vol. III. Chapters XVI and XIX respectively deal with general notions on ferrous alloys, copper alloys, light alloys, and babbitt metal and other special alloys.

The book is written in French, in simple language, and the illustrations are generally in the form of clear sketches. There is no alphabetical index, but the table of contents is subdivided into many subsections under the main headings, and constitutes an analytical index.

Moves Main Office

The Chicago office of the Whiting Corp., Harvey, Ill., has been removed to the Marquette building, 140 South Dearborn street, Chicago.

Oliver Smalley, recently elected president of the Meehanite Metal Corp., 107 Vandergrift building, Pittsburgh, sailed for England recently for several weeks' business engagements.

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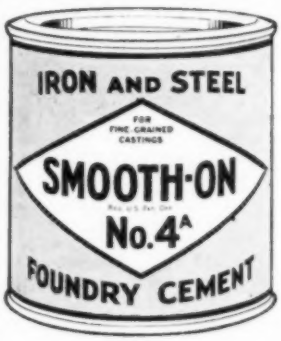

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Just like a lily of the field

The Adventures of Bill

BY PAT DWYER

MANY years ago a Tinpan alleyite—probably with his tongue in his cheek—wrote the words of a popular song *Everybody Works But Father*. Remember? "Mother takes in washing. So does sister Anne. Everybody works in our house but my-old-man!"

This incredibly lazy, stocking footed old gent—according to the inspired composer—spent all his time in front of the fire smoking his pipe of clay. A captious critic might feel inclined to suggest that the average man usually smokes a pipe of tobacco, but due allowance must be made for poetic license and the necessity of providing a word to rhyme with *day* in the preceding line of the song.

The author may or may not have had a particular old smoker in mind when he composed the ditty which tickled the risibilities of an easily amused and not overly critical populace, but certainly he was *not* referring to Joseph A. Kalina, for the past 50 years a metal patternmaker at the plant of the Eberhard Mfg. Co., Cleveland.

Combined with the huge frame, the mightly arms and the large and sinewy hands which one naturally associates with a blacksmith, a trade which he learned in his native Bohemia, Joe has a set of fingers as delicate and sensitive as those of a surgeon or a skilled watchmaker. Keen delight which other men enjoy through sight, sound, taste, or smell, Joe finds in the sense of touch, the employment of these nimble fingers.

In his immediate circle he is known as *The Fixer*. When anything goes wrong with any kind of mechantical contrivance, from a mousetrap to a player piano, it is turned over to Joe with implicit faith in its restoration. The skilled hand and the cunning eye are supplemented by an ingenious brain and a placid disposition that never acknowledge defeat.

Occasionally he is baffled temporarily in the solution of a problem. The mechanism over which he has toiled for hours fails to function. Where the average man would indulge in a war dance accompanied by explosive language and end up by smashing the thing with a 14-pound sledge, Joe calmly wipes his hands and retires briefly to his favorite easy chair.

Here he indulges in a few chapters of an excellent Bohemian translation of the adventures of Tarzan. With an American background of over 50 years, he reads and speaks English fluently, but he derives a keener pleasure in reading the thrilling adventures of the intrepid hero among the apes when set forth in the language of his boyhood.

He then tackles the problem again. In some instances the process has been repeated several times, but inevitably patience and Tarzan bring the desired result.

In 1913 Joe visited Bohemia with the intention of spending a year in lordly idleness. He endured the painful ordeal for three months and then joyfully returned to his bench in the patternshop and to his hobby of fixing things in the neighborhood.

The movement is mounted on a bench, the weights hang from the ceiling

While in his native village, near Pilzen, he was implored by a committee of worthy citizens to repair the village clock and once more set it in motion. This little job, executed to the eminent satisfaction of all and sundry, started a train of thought in his mind which later culminated in the construction of a clock of his own. With characteristic modesty, this marvel of ingenuity and pains taking hand labor was erected in the patternshop where it has been ticking off the hours and minutes with meticulous accuracy for the past 17 years.

The mechanism is actuated by two cast iron 40-pound weights suspended from fine steel cables attached to two wood drums in the clock and reeved through pulleys attached to the ceiling. One drum controls the movement and the other the striking mechanism. In the process of winding the clock, each drum is revolved by a small hand crank projecting from the side.

A few parts were salvaged from the scrap pile, but in the majority of instances Joe made the patterns, molds and castings and cut the teeth in the gears with chisel and file. The base and upright frames are aluminum. The gears, ratchets, pawls, levers and rods are iron or steel. The weight on the end of the pendulum rod is a 75-millimeter shell partly filled with loose slugs. Through an electric and compressed air hookup the clock strikes the hours on a gong and blows a whistle, morning, noon and night.

Joe's hands are large and rough and his fingers would be the despair of a manicurist, but they are the hands of a creative artist, a cunning artizan, one of the gifted members of a long line extending back to Hiram of Tyre's master mechanic, *skilful to work in gold, and in silver, in brass, in iron in stone and in timber, in purple, in blue and in fine linen, and in crimson; also to grave any manner of graving, and to find out every device which shall be put to him.*

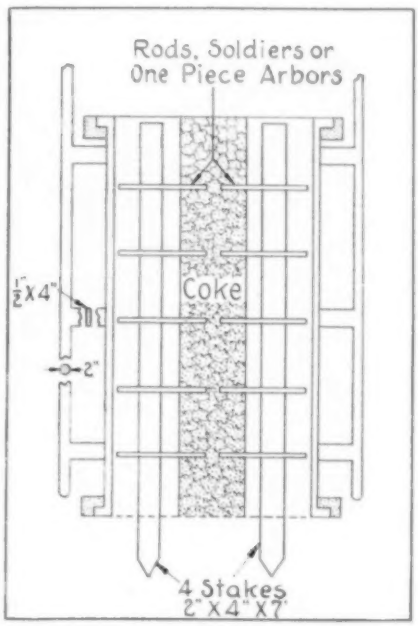
I mentioned Joe's career to Bill the other night in a general discussion of handicraft in the foundry and he immediately was reminded of an inquiry he had recently from a man who had tried to make a pipe casting 3 feet diameter, 6 feet in length, flanged at both ends. The mold was made vertically in a pit in the floor from a wood ring pattern 2 feet high which formed core and mold. The bottom flange was formed in cores and the ring pattern was drawn up after each third or forth ramming until the desired height of 6 feet was reached. The upper flange also was formed in cores and the mold was covered with a flat cope. Large chunks of sand fell way from the core after the ring pattern was removed and he was at a loss how to continue.

Bill wrote him to the effect that on account of the many hazards incident to a job of that kind, the casting really should be made in a loam, a dry sand or a skin dried mold with preference for each type in the order indicated. However, by observing all the proper precautions, a highly skilled molder can produce a fairly passable casting from a green sand mold. The principal hazard lies in the volume of steam generated while the iron is rising in the mold. Unless this steam finds ready egress through the sand, part of it will enter the mold cavity and set up an ebullition in the molten iron with consequent porosity of the metal and tearing away of the sand walls of the mold. The core contains approximately 42 cubic feet of sand. Assuming a minimum water content of 6.00 per cent, this means that about 1½ cubic feet of water will be evaporated in less than 1 minute, the period in which the metal is filling the mold. Obviously an extremely porous core is required to permit this immense volume of steam to escape readily. To a somewhat less extent the same condition must be observed in the outside wall of the mold.

Two inferences may be drawn from the description of the defective core. One is that large chunks of sand actually fell away from the core. The other is large defective areas on the casting led to the assumption that large pieces of sand became detached before the iron entered the mold. If the first inference is accurate, the fault lies with the manner of constructing the core. The mechanical details are not satisfactory. If the second inference contains the true explanation, then it may be that the construction of the core is satisfactory so far as the stability is concerned, but it is not sufficiently porous. Steam generated by the iron forced pieces of sand out of place and formed unsightly scabs on the surface of the casting.

Irrespective of which cause is responsible for the defect, the following is submitted for the proper construction of the mold and core. A casting made in a loam or dry sand mold could be gated on top through a ring of small pop gates. This is the ideal method and conforms to theory and the best accepted practice. However, this method is not feasible in the green sand mold under discussion. The falling streams would erode the sand walls and produce a mass of slush to be later held at various points in the wall of the casting or in the upper flange. Certainly the casting would not pass a pressure test.

Commencing at the bottom with the



Cross section of upright pipe mold showing core construction and position of gates

lower flange cores in place around the ring pattern, four 7-foot lengths of 2 x 4-inch scantlings, claywashed and pointed at the lower ends are driven at four equidistant points into the sand and about 6 inches inside the ring. The upper ends will project to within an inch of the top. These stakes will impart the necessary rigidity to the core and also will anchor it solidly to the bottom. Where a considerable number of castings are required old boiler tubes may be used instead of stakes and light open sand cast iron arbors may be substituted for the rods or soldiers in the core. One of these arbors is bedded down on every second course of rammed sand.

A small pattern or other circular object approximately 12 inches in diameter is placed in the center and sand is rammed to the top of the pattern ring inside and outside. The inside ring then is removed and the cavity filled with coke or cinders. A row of soldiers or rods is laid horizontally on the sand of the core, approximately 4 inches apart near the pattern and coverging to the center. Similar reinforcement is placed on the sand outside the ring pattern. A coke ring is laid on the sand on the outside about 4 inches back from the pattern. Six sticks 1 x 3 inches in cross section and 2 feet in length are erected equidistantly in this coke ring. The pattern ring then is drawn upward 12 inches. The inside ring is replaced and sand is rammed in the usual manner inside and out, with the reinforcing soldiers or rods at every course. A coke ring is placed at about every foot in height on the outside of the mold and the sticks are drawn upward as required. The column of coke in the core is continuous.

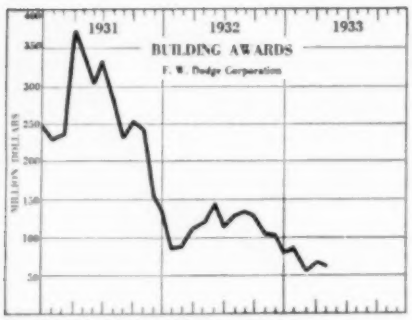
This procedure is continued to the top of the mold. The sticks then are removed and suitable provision made at the joint for the gas and steam to escape. A large hole is left in the center of the cope for the same purpose. As an added precaution a piece of 6-inch pipe may be placed upright in the hole with the lower end resting in the coke center of the core. Sand then may be rammed around the pipe, thus forming an effectual seal on top of the core.

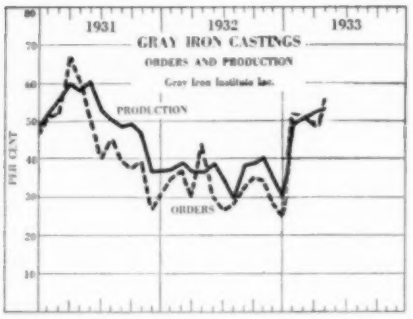
To insure a rapid filling of the mold with iron, two vertical sprues 2 inches in diameter, and set diametrically opposite each other are recommended. Each sprue is connected to the mold cavity through three narrow vertical gates ½ x 4 inches, the first about 12 inches from the bottom, the second near the center and the third immediately below the upper flange core. A piece of dry sand core is bedded in the core opposite each gate. The sprues are connected at the top by a long pouring basin.

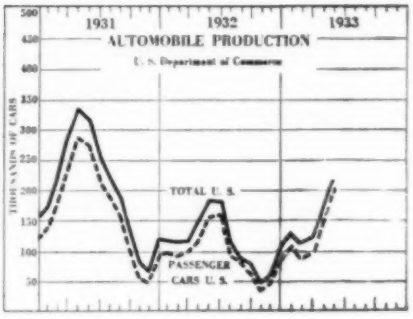
Since the mold is not parted and therefore no opportunity presented for slicking or blacking the face, it is quite probable that a certain amount of slush will be collected and carried to the top. Prudence suggests the addition of an extra inch of metal to the face of the top flange, later to be machined off if a perfectly clean face is desired. The addition of coal dust, 1 to 6 at the bottom and 1 to 8 or 9 further up will produce a fairly clean skin on the casting.

The sand must be rammed hard at the bottom inside and outside to prevent the casting from straining. Further up, particularly in the core, the sand does not need to be rammed so hard. Even under the most favorable conditions a high green sand mold will strain to a certain extent when it is filled with molten iron. Therefore, it is advisable to place four 4-inch risers on the upper flange to compensate for metal drawn away by the straining metal. Otherwise the molder may find shrinkage cavities on top of the upper flange, or draws or cracks on the under side of the same flange.

Aluminum Co. of America recently moved its headquarters to the Gulf building, Pittsburgh.







Foundry Activities

Reflect Industrial Trends

SOUTHERN MALLEABLE IRON CO., Twenty-first street and Bond avenue, East St. Louis, Ill., recently has been operating on a day and night basis with orders from railroads and automobile and stove manufacturing companies. Operations for the first 2 weeks in May were within 5 per cent of the 1929 average.

* * *

Sparta Foundry Co., Sparta, Mich., reported the best business in April of any month during the past 2 years.

* * *

Suburban Bronze Works Inc., Jamaica, N. Y., recently was incorporated with $3000 capital to operate a foundry.

* * *

Waterloo Foundry Co., Waterloo, Iowa, recently started operations. Peter C. Andersen and Carl W. Andersen are proprietors.

* * *

American Radiator-Standard Sanitary Corp., Buffalo, recently purchased the Ross Heater & Mfg. Co. Inc., Buffalo.

* * *

Contract for alterations to the foundry building at the U. S. navy yard, League Island, Philadelphia, recently was awarded to B. J. McKenna. Estimate for the work was $47,870.

* * *

Brass foundry of the American Radiator-Standard Sanitary Corp., 1541 South Seventh street, Louisville, Ky., recently resumed operations after being idle for one month.

* * *

Acme Brass & Aluminum Foundry, 1125 Twenty-first street, Oakland, Calif., has started operations on a general line of brass and aluminum castings. John M. Rae and Walter E. Spring are owners.

* * *

New Jersey Foundry Co., Harrison, N. J., has leased for a long term a one story building at 300 Bergen avenue. George Franz is president of the company, which manufactures brass, bronze and aluminum castings.

* * *

J. P. Ward Foundry Co., Blossburg, Pa., recently awarded the contract to F. P. Case & Sons for the erection of a foundry building 40 x 290 feet. A substantial increase in business during the past few months has necessitated the increased production facilities.

RAW MATERIAL PRICES
May 27, 1933

Iron	
No. 2 foundry, Valley	$15.50
No. 2 Southern, Birmingham	12.00
No. 2 foundry, Chicago	16.00
No. 2 foundry, Buffalo	16.00
Basic, Buffalo	15.50 to 16.00
Basic, Valley	15.00
Malleable, Chicago	16.00
Malleable, Buffalo	16.50
Coke	
Connellsville beehive coke premium	$4.00
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$12.00 to 12.50
Heavy melting steel, Pitts	11.50 to 12.00
Heavy melting steel, Chicago	8.25 to 8.75
Stove plate, Buffalo	8.00 to 8.50
Stove plate, Chicago	7.00 to 7.50
No. 1 cast, New York	5.50 to 6.00
No. 1 cast, Chicago	8.50 to 9.00
No. 1 cast, Pittsburgh	10.50 to 11.00
No. 1 cast, Philadelphia	10.00 to 10.50
No. 1 cast, Birmingham	7.50 to 8.50
Car wheels, iron, Pittsburgh	11.00 to 11.50
Car wheels, iron, Chicago	9.50 to 10.00
Railroad malleable, Chicago	9.75 to 10.25
Agricultural mal., Chicago	7.50 to 8.00
Malleable, Buffalo	10.50 to 11.50
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	7.00
Straits tin	37.00
Aluminum, No. 12, producers	19.00 to 22.00
Aluminum, No. 12 remelt Cleveland	10.50 to 11.50
Lead, New York	3.75
Antimony, New York	6.25
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	3.95 to 4.00

Allis-Chalmers Co., Milwaukee, is realizing an increase in business, according to Gen. Otto H. Falk, chairman of the board. Sales of farming implements as well as other lines of the firm's business have shown improvement during the past thirty days.

* * *

West Michigan Steel Foundry Co., 1148 Western avenue, Muskegon, Mich., recently was operating 5 days a week with a force of about 180 persons, or 30 per cent more than during the first three months of 1933. Otto A. Seyforth is president and general manager.

* * *

Robert Holmes & Bros. Inc., 520 Junction street, Danville, Ill., received more orders for machinery during the first week of May than were secured during the entire month of April. Inquiries also have shown a remarkable increase. The company specializes in coal mining machinery.

* * *

Lowe Foundry Co., Ottumwa, Iowa, has leased the foundry of the Whisler Mfg. Co., 513 West Main street, Ottumwa, has added some new equipment and placed the plant in operation. B. H. Lowe is secretary of the new company, Clem Leedom is superintendent, and L. L. Davolt is foundry foreman.

* * *

L. J. Mueller Furnace Co., 197 Reed street, Milwaukee, recently increased production by adding 110 men to its force on a 3 day a week basis in the foundry and sheet metal departments. Increased activity is made possible by improved demand for equipment, particularly for residential air conditioning, according to H. P. Mueller, president and general manager.

Main building of the Wisconsin Gray Iron Foundry Co., 4432 West Burnham street, Milwaukee, recently was damaged by fire with an estimated loss of $25,000.

* * *

Doehler Die Casting Co. is establishing departments at its Pottstown, Pa. plant to cast and assemble aluminum die castings. The company reports an increase in business recently.

* * *

Chase Foundry & Mfg. Co., 2300 Parsons avenue, Columbus, O., recently increased its line of products with the addition of a machine for manufacturing ice cream. The new type of machine was developed by the engineering department of the Chase foundry. Philip A. Myers of Ashland, O., is president; Arthur J. Dunn, first vice president and general manager, and J. C. McMillen, secretary-treasurer.

New Trade Publications

SAND MIXERS—National Engineering Co., 549 West Washington boulevard Chicago, recently has published an attractive catalog illustrating and describing its line of intensive sand mixers. The first part of the publication is devoted to a discussion of the uses to which this type of mixer has been applied successfully, a general description of the equipment and a discussion of the principle of operations, information on the automatic discharge feature, and the advantage of batch control. The remainder of the catalog is devoted to exceptional photographic reproductions of the various machines together with information on features of design and application. General specifications of the seven sizes of mixers produced by that company are presented on the final page.

FLASKS—Foundry Equipment Ltd., 15 Victoria street, Westminster, London, S.W.1, has published a folder describing its line of snap flasks, slip flasks and pouring jackets.

WELDERS—Two leaflets describing the new 300 and 400 ampere gasoline driven welders have been published by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These welders may be used with bare or coated electrodes.

LININGS—Stebbins Engineering & Mfg. Co., Watertown, N. Y., has published a bulletin on acid, alkali and corrosion resisting linings for industrial equipment. Information on the history and service offered by the company also is presented.

SAND EQUIPMENT—Sand sifters, sand mills, sand disintegrators, a sand plant and core sand mixers are described and illustrated in a recent bulletin of Foundry Equipment Ltd., 15 Victoria street, Westminster, London, S.W.1.

COMPRESSED AIR — Foundry Equipment Ltd., 15 Victoria street, Westminster, London, S.W.1, has published a folder on compressed air accessories for the foundry. The publication describes sand rammers, hoists, vibrators, rotary grinders, compressors, hose and couplings.

CHAIN—Chain Belt Co., Milwaukee, has published two folders devoted to various types of chains, including detachable, pintle and conveyor chains, roller and snake chains, Z-metal chains, steel roller chains, etc. Illustrations show the various types of chains described.

IMMERSION HEATERS—General Electric Co., Schenectady, N. Y., has published its bulletin No. 214B on helicoil sheath-wire immersion heaters, designed for heating water, oil and various other liquids. Table of standard sizes, description of the mechanism, and methods of operation and control are presented in the text.

WELDING AND CUTTING EQUIPMENT—Smith Welding Equipment Corp., Minneapolis, has published its catalog of oxy-acetylene welding and cutting equipment including tips, cutting assemblies, welding torches, cutting torches, oil preheating torches, soldering outfits, oxygen and acetylene regulators, etc.

ELEVATOR BUCKET WASHERS —A washer which acts as a springy, elastic cushion and lessens the strain on the bolts at the moment of passing over the pulley is discussed in a folder recently issued by the B. F. Goodrich Rubber Co., Akron, O. Rubber pulley lagging to increase the coefficient of friction between a rubber belt and a dry pulley face also is discussed in the bulletin.

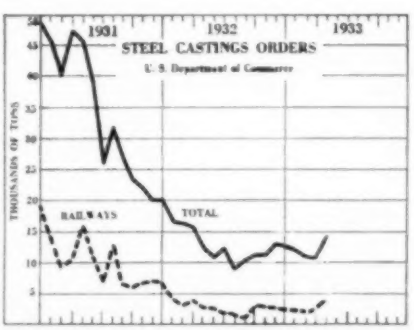
EMPLOYE HANDBOOKS — The Policyholders Service bureau, Metropolitan Life Insurance Co., New York, has published a booklet discussing informative handbooks of various types published by numerous companies to acquaint employes with ideas, methods and policies of the organization and to give complete undertsanding of the rules and regulations of the office, store, factory or other department.

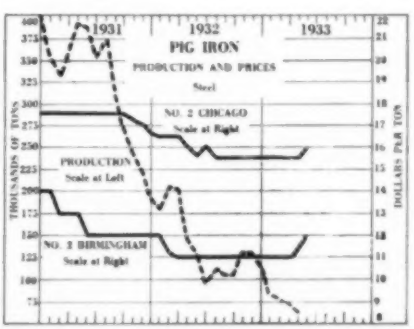
ELECTRICAL EQUIPMENT—Harland Engineering Co. Ltd., Alloa, Scotland, has published several bulletins devoted to its equipment designed to control and protect electrical plants and afford instant and safe means for examining its compotent mechanism. The switchgear and apparatus are mounted on a movable chassis which, in the working position, completely embraces the live parts and withdrawn, leaves the fixed live contacts masked.

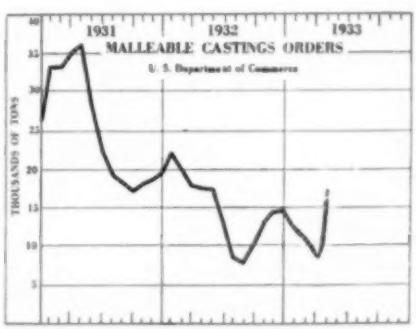
SPEED REDUCER—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has published a bulletin describing its unit consisting of an electric motor combined with a built-in speed reducer. A unit of the same type which permits 4-speed operations with a constant speed electric motor is described in another bulletin. Illustrations include several applications together with detailed views of each model. Tables of output speeds for each model are also included in the bulletin.

MOLYBDENUM — Climax Molybdenum Co., 295 Madison avenue, New York, recently has published a 1933 supplement to its former catalog "Molybdenum in Cast Iron." The brochure includes a detailed discussion of the effect of adding molybdenum to gray cast iron, the industrial and other uses of gray iron castings alloyed with molybdenum, the use of that alloy in white iron and in malleable cast iron. Tables give extensive data on physical properties and micrographs present information on the changes in grain structure provided through the addition of molybdenum.

MEEHANITE — Meehanite Metal Corp., Chattanooga, Tenn., recently has published a bulletin entitled "The Engineer Investigates Meehanite" which presents graphically the physical properties, casting problems, accuracy, production time, service qualities and machinability of that metal. The bulletin also presents micrographs to show the structure of the metal and presents a discussion of several methods of processing which may be applied to the metal to provide the physical properties necessary in the particular service for which the casting is designed. A list of foundries manufacturing that type of casting also is included.







Classified Ads

Help Wanted

CASTING SALESMAN

Chicago district to handle sales of malleable, grey iron, semi-steel, alloy grey iron and Z-Metal castings on commission basis. Must know territory and have casting sales experience. Address Box 706, THE FOUNDRY, Cleveland.

WANTED

Salesman familiar with foundry practice, prefer one who has had cleaning room experience, to sell our product. Must be able to invest $2,500.00 in the business. Address Box 705, THE FOUNDRY, Cleveland.

DEMONSTRATING REPRESENTATIVE

wanted in every foundry district, for a NEW and PROVEN effective molding appliance for loose patterns and gates. No competition. Proposition covers protected territory on attractive commission basis. Applicant must have foundry experience. State training and experience fully. Address Box 598, THE FOUNDRY, Cleveland.

Employment Service

IF YOU ARE OPEN TO OVERTURES FOR new connection, and qualified for a salary between $2500 and $25,000, your response to this announcement is invited. The undersigned provides thoroughly organized service of recognized standing and reputation, through which preliminaries are negotiated confidentially for positions of the calibre indicated. The procedure is individualized to each client's personal requirements; your identity covered and present position protected. Established twenty-three years. Send only name and address for details. R. W. Bixby, Inc., 101 Delward Building, Buffalo, N. Y.

ATTENTION FOUNDRY OWNERS

Write or wire us for technically-trained practical foundry foremen, superintendent, production managers, chemists, metallurgists, core foremen, cost clerks, salesmen, patternmakers, melters (electric, open-hearth, converter and cupola.) No charge. Licensed Agency, McLAIN'S SYSTEM, INC., 804 Goldsmith Bldg., Milwaukee, Wis.

Positions Wanted

GRAY IRON FOREMAN

or superintendent on work from 1 lb. to 50 tons. Specialized heavy machine castings. Mix by analysis. Many years experience as molder foreman and superintendent. Address Box 567, THE FOUNDRY, Cleveland.

PRACTICAL 32 YEARS MOLDER AND SUperintendent. Complete responsibility. Good record in sales, handling men, equipment, cupola, production or jobbing. Address Box 676, THE FOUNDRY, Cleveland.

ATTENTION
OHIO AND MICHIGAN FOUNDRIES

Expert wood patternmaker. Particularly skilled on automotive and machinery patterns. Accustomed to fine accurate work. Age 37. Available part or full time. Address Box 710, THE FOUNDRY, Cleveland.

GRAY IRON FOUNDRY SUPERINTENDENT

Practical man 25 years gray iron semi-steel take complete charge handle men well. Mix iron by analysis. Best reference. Go anywhere. Address Box 717, THE FOUNDRY, Cleveland.

NONFERROUS FOREMAN

Thorough experience on all nonferrous metals. Light or heavy castings. Take full charge mixing, melting, coremaking and molding. Age 50. Good health. Thoroughly reliable. Available now. Address Box 708, THE FOUNDRY, Cleveland.

MANAGER OR SUPERINTENDENT

Eleven years practical experienuce producing large and small steel and alloy castings. Electric and open-hearth. Technical education; also sales experience. Excellent references. Age 35. Address Box 719, THE FOUNDRY, Cleveland.

GRAY IRON FOUNDRY SUPERINTENDENT

Practical man 25 years in gray iron, semi-steel and alloyed iron. Take complete responsibility metallurgical work, estimating and production. Experienced mass production on light work, castings up to 85 tons; tractors, electrical work, generators, pumps, compressors, diesel and blast furnace gas engines, turbines, machine tool, general machinery. Can produce high grade castings at low cost. Good organizer. Age 44. Address Box 588, THE FOUNDRY, Cleveland.

Positions Wanted

GRAY IRON FOREMAN

25 years experience. Large and small fittings, machinery, general jobbing. Twelve years foreman two largest shops Birmingham, Alabama. References from both. Address Box 709, THE FOUNDRY, Cleveland.

PRACTICAL FOUNDRY SUPERINTENDENT

with a fine background. Experienced with cupola and electric high test gray iron, 50,000 tensile. Mix by analysis. Can handle all departments. Read blue prints. Address Box 661, THE FOUNDRY, Cleveland.

FOREMAN OR SUPERINTENDENT

of stove foundry. Middle age and able. 10 years experience with one of the best and largest stove foundries in the country. Good references. Address Box 707, THE FOUNDRY, Cleveland.

BRASS FOUNDRY FOREMAN

Specialized on plumber's brass goods and jobbing. Good metal mixer—brass, bronze and aluminum. Address Box 662, THE FOUNDRY, Cleveland.

STEEL FOUNDRYMAN

Wide experience in carbon and manganese steel foundry operation and production methods. Thoroughly capable of operating foundry on a low cost basis. Address Box 704, THE FOUNDRY, Cleveland.

GRAY IRON SUPERINTENDENT

Efficient, up to the minute in all modern methods of foundry practice. Practical in coremaking, molding, cupola practice and patternmaking; expert rigger for high production at minimum cost. Can handle all classes of help successfully. 15 years executive. Age 42. Married. Address Box 678, THE FOUNDRY, Cleveland.

FOUNDRY AND PATTERN SHOP SUPT.

desires to make a change. Specialized in automotive and stationary engine castings. Practical patternmaker and foundryman with technical training. Good executive and an excellent record. 20 years experience. Age 38. Prefer large or medium foundry. Address Box 718, THE FOUNDRY, Cleveland.

METALLURGICAL-CHEMIST

Technical education. Experience covers electric cast iron, continuous permanent molding, heat treatment, physical testing, electro-plating, finishes, control for steel and cast iron and general miscellaneous analysis. Would like position with future as assistant to manager. References. Address Box 647, THE FOUNDRY, Cleveland.

GRAY IRON FOUNDRYMAN

Thoroughly experienced on medium weight castings—mixing, melting and cupola practice. McLain graduate. Familiar with foundry management, cost accounting, metallography and heat treatment. Member A. F. A. Age 45. Excellent health. Will locate anywhere in U. S. Salary open. A1 references. Available August 1. Address Box 712, THE FOUNDRY, Cleveland.

GRAY IRON SUPT. OR MANAGER

Thoroughly experienced in all branches of foundry practice. Twenty-five years experience in responsible executive positions. Excellent references. Address Box 684, THE FOUNDRY, Cleveland.

FOUNDRY SUPERINTENDENT

25 years proven ability. Grey iron, semi-steel, nickel alloy iron. Skilled molder. Experienced foreman, superintendent, metallurgist. Technical experience. Good organizer. Demonstrated ability in cost reduction and production of quality castings. Mix iron by analysis. Expert cupola practice. Address Box 702, THE FOUNDRY, Cleveland.

EXPERIENCED FOUNDRYMAN

has held every position from pattern boy to general manager in a large middle west foundry making light and medium castings of every description including automotive castings. Address Box 715, THE FOUNDRY, Cleveland.

FOUNDRY SUPPLIES SALESMAN

35 years experience as core room, foundry foreman and sand efficiency expert. Thoroughly familiar with all foundry supplies and equipment. Good references. Address Box 711, THE FOUNDRY, Cleveland.

Positions Wanted

PRACTICAL ALL AROUND FOUNDRYMAN

26 years of experience in jobbing and production shop. 5 years actual cupola practice. Address Box 663, THE FOUNDRY, Cleveland.

FOUNDRY SUPERINTENDENT

Capable of assuming responsibility. Experienced in medium and heavy gray iron and semi-steel machinery castings; also the new alloy metals. Prefer permanent connection but would consider temporary work in an advisory capacity where foundries were having trouble with iron mixtures, cupola practice, etc. Address Box 675, THE FOUNDRY, Cleveland.

METALLURGIST-ASST. SUPT.

Engineering graduate. Seven years practical foundry experience. Cupola and electric furnace melting of gray iron and steel. Sand control. General foundry operation. Especially suited for technical problems. Address Box 685, THE FOUNDRY, Cleveland.

METALLURGICAL ENGINEER

Exceptional training and wide knowledge of steel and gray iron, open hearth and electric furnaces. Successful record in sales and plant development of heat treated and alloy castings. Address Box 601, THE FOUNDRY, Cleveland.

CAPABLE MANAGER

Eighteen years practical and executive experience, production and jobbing. Have been plant manager for large pipe concern for past six years. Excellent references. Address Box 681, THE FOUNDRY, Cleveland.

GRAY IRON FOUNDRYMAN

Twenty-two years proven ability as foreman and superintendent. Experienced light to heavy jobbing. Mix by analysis, up-to-date on modern foundry methods. Wish opportunity to invest in foundry in need of a first class practical man. Address Box 654, THE FOUNDRY, Cleveland.

FOUNDRY MANAGER

Malleable or gray iron. Twenty-five years experience. Past ten years general manager large corporation, malleable division. Can handle entire operations, sales, and factory. Many new accounts ready to be taken to new connection. Very highest references. Address Box 674, THE FOUNDRY, Cleveland.

GENERAL MANAGER

with splendid record in managing, building up and rejuvenating foundry, machinery, tool and allied industries is open for a new position. Ability to economically and efficiently handle all office, sales, financial and factory activities unquestionably established by previous experience. Address Box 453, THE FOUNDRY, Cleveland.

ATTENTION
WESTERN U. S. AND CANADIAN FOUNDRIES

Experienced Pipe Foundry Superintendent available. Age 38, married. Several years experience on high pressure soil pipe. Have produced results for leading pipe foundries. Prefer location in Western United States or Western Canada. Valuable research experience on pipe casting. Salary open. A1 references. Address Box 699, THE FOUNDRY, Cleveland.

GRAY IRON SUPERINTENDENT

23 years experience light to medium jobbing and production. Specialized in all types furnace work. Know molding, jolt machines, sandslingers. Technical and practical training. All-around man. Capable, efficient, reliable. Interview requested. Address Box 679, THE FOUNDRY, Cleveland.

FOUNDRY EXECUTIVE—GRAY IRON

26 years experience. Past 18 years foreman, superintendent and assistant manager. Production and jobbing. Technical education. Will accept any position that gives opportunity to produce efficiently and economically better castings. Age 42. Address Box 669, THE FOUNDRY, Cleveland.

BUYER SALES REPRESENTATIVE OR METALLURGICAL SUPERINTENDENT FOR BRASS AND BRONZE INGOT PRODUCER. EXPERIENCED. CAPABLE. AMERICAN TECHNICAL GRADUATE. CAN OBTAIN RESULTS. WELL ACQUAINTED IN TRADE. HIGHEST REFERENCES AND FULL DETAILS FURNISHED. ADDRESS BOX 714, THE FOUNDRY, CLEVELAND.